THURSDAY, SEPTEMBER 8, 1870

THE MEDICAL SCHOOLS OF ENGLAND AND GERMANY*

II.

THE German University System, described in our last article, has been recently extended to other parts of the Continent. In Holland, for example, the progress made in this direction of late years has been immense, considering the small extent of the country. Again, in France, at the time that Duruy was Minister of Public Instruction, a measure was adopted which was prompted by the same tendency. One of the most distinguished *savants* of that country (Prof. Wurtz) was sent into Germany to collect information as to the great institutions which exist in that country for the promotion of natural science. The results of this inquiry are embodied in a voluminous report, illustrated with plans of the most important buildings. The favourable impression made on the mind of M. Wurtz by all that he saw in this journey may be judged of by the terms employed in the final paragraphs, in which he sums up his conclusions, and enforces the necessity of introducing German organisation into France.

If we pass from the consideration of the resources of English schools to the functions they perform and the ends they have in view, the contrast between Germany and England becomes still more striking. All German professors are State officials, and hold their posts, with rare exceptions, for life. Consequently, the special work which they have to perform in virtue of their calling is the purpose to which they have voluntarily devoted their existence. In Germany a young man who makes up his mind to a scientific career, dedicates himself from the first to the particular branch of science which he intends to follow, and remains true to it to the end. In this way he acquires a mastery over his speciality which could not be attained in any other way; and if he is a man of mark, he becomes the centre of what in Germany is called a "School," that is to say, he acquires a following of younger men to whom he communicates the precious fruits of his own work; partly orally; partly by demonstration, in such a way that the pupils learn from him in a short time, and in the most advantageous manner, what it would take years to acquire by self-instruction. In England, on the other hand, with the exception of the few scientific men who have studied in Germany, all are what we call "Autodidacten"—*i.e.* self-taught men, who have acquired their knowledge in spite of the want of opportunities. For there are very few investigators by profession, and, in the sense above referred to, no "Schools." The number of those who hold University Professorships is extremely small, and among these even there are few who, in the absence of independent means, are willing to devote themselves exclusively to a pursuit which brings in nothing.

Those who belong to that section of the community which is most fruitful in workers—those, namely, who are without the advantages either of birth or means—cannot, for want of substance, devote their lives to physiological research with that completeness which is necessary if great results are to be obtained. The most that they can do is to give their early years to investigation, with the understood intention of eventually abandoning natural science for those practical duties which are to be the occupation of their mature life, as well as the substantial reward of their previous labours. For the development of science great part of their work is lost, partly because there are no laboratories for instruction, but still more because their time becomes absorbed in other occupations at the very period at which it could be most advantageously devoted to this purpose.

It must, however, be borne in mind that, in Austria at all events, it was not zeal for science that induced the Government to take charge of its interests. The motive is rather to be looked for in the tendency which then existed to keep everything under the management of the central authority, and to maintain its control over all social relations. It is, however, of little consequence how the system originated; for a tree that bears good fruit is none the worse for the foulness which lies about its roots. Some may be inclined to doubt whether it is after all advantageous that the sciences should be represented in the Government. It will not be difficult to answer the question. The man who is occupied exclusively in research (and it is only such workers that science really cares for) is very slow in reaping the fruits of his labours. The results which are to be attained in the laboratory, however valuable they may be as materials for the future enrichment and development of the people, are not marketable. A single truth may afford work for a decennium, and often only begins to be productive after the death of its originator. The position of the philosopher is special. No one is more helpless and more completely dependent on the support of the public. With the artist, who stands in a closer relation to the man of science than any one else, it is far otherwise; for the wealthy patrons, whose houses he ornaments with his works, even if they are not always capable of appreciating them, are willing to pay him for them liberally. But in the case of the philosopher, it often happens that the work of many years may be compressed into a few pages.

A nation so well-to-do as the English might perhaps be expected to afford the means for the support of science independently of the Government, especially now that the value of scientific culture is better understood than formerly. But even if the means were forthcoming, there would be no guarantee for their efficient distribution, unless that distribution were placed under the control of competent and responsible persons capable of justly estimating the future worth of a scientific worker from the earliest products of his mind. For this forecasting, endowments are necessary which are not to be met with everywhere and at all times. It is a great gain to any country to possess men fit to be entrusted with this responsibility; but, in order that they may be really useful, it is absolutely necessary for them to be in immediate relation with the central Government.

I have so far entered only into the general features of higher scientific education, without making any very special reference to medical studies. For the purpose of taking a more detailed view of the subject, we must examine more particularly the mutual relations of hospital and school. This will form the subject of a subsequent paper.

S. STRICKER

* Continued from p. 350.

ON AN UNPUBLISHED ITALIAN MS. OF THE SEVENTEENTH CENTURY

NOT long ago I acquired an MS., entitled *Estratto del Libro, segniato A; di Prete Antonio Neri,* which I think is of sufficient interest to merit a short notice in these pages. In the first place, let us make ourselves familiar with the life and writings of the priest Antonio Neri. The greater number of biographical dictionaries do not even mention him, but the "Biographie Universelle," and Hoefer's "Nouvelle Biographie Générale" are exceptions, both giving a short account of him. As to the time of his birth, I can nowhere find a more definite date than *vers le milieu du seizième siècle,* while Poggendorff alone mentions the year of his death, which occurred in 1614. Antonio Neri was born in Florence, and was educated for a priest; but he appears never to have undertaken priestly duties, preferring to devote his time to chemical and physical studies. For the purpose of extending his knowledge in this direction, he travelled all over Europe, collecting scientific *secrets,* as they were then called, and he succeeded in amassing a large number of these. He visited the principal laboratories of Europe, and resided for some length of time in Antwerp, where he wrote his treatise on the art of colouring glass. He did not hesitate to work as a common assistant, performing the most menial operations of the laboratory, when he found it impossible to gain access to the secrets he sought by other means.

The period in which Antonio Neri lived coincides most nearly with that of his countryman Baptista Porta (born 1537, died 1615). Paracelsus died about the time of the birth of Neri; Jerome Cardan died when he was a boy; Van Helmont was thirty-five years old when Neri wrote his "L'Arte Vetraria;" Galileo and Francis Bacon had not reached the summit of their fame; Robert Fludd was busy with his "Historia Macrocosmi;" Glauber was a boy, Kunckel an infant, Becher was unborn. The Paracelsian iatro-chemistry was making way, Crollius was supporting it, while Libavius was the leader of the opposition; the famous "Tyrocinium Chymicum," of Beguinus, was about to appear; the "Academia Secretorum Naturæ," founded by Baptista Porta, had just been dissolved by Pope Paul V., on the ground that magical and unlawful arts were practised by its members; but the proceedings of this first of the scientific societies remained in the treatise "Magiæ Naturalis," which was the most popular scientific book of the period. Such was the state of the scientific world when Neri laboured and wrote.

The only work ever published by Neri was the treatise on glass-making, to which I have referred. This is a small quarto of 114 pages, and is entitled: "L'Arte Vetraria distinta, in libri sette del R. P. Antonio Neri Fiorentino. In Firenze, 1612. Con licenza di Superiori.'

The order of the ecclesiastical authorities for printing this work is conveyed in no less than seven forms, which are signed, countersigned, attested, and endorsed, and bear dates ranging between March 30 and April 7, 1612. This excessive scrutiny may appear strange at first sight, but let us glance for a moment at collateral facts. The "Index Expurgatorius" had been established by Paul IV. in 1559, and in the very first issue no less than sixty-one printers had been condemned, and the reading of works which issued from their presses forbidden. Now, there was still greater need for caution on the part of the Church; for had not a certain fellow-countryman of Neri, named Gordano Bruno, recently propagated all sorts of heresies in his "Cena de li Ceneri," and had he not suffered death for his temerity? And was there not a contemporary and countryman of Neri, whilom professor of mathematics in the university of Padua, who had shown particular relish for the doctrines of Copernicus, and a particular disrelish for those of Ptolemy and Aristotle, and altogether an insufficiency of respect for the Church? Thus it was that the utterly inoffensive "L'Arte Vetraria" came to undergo so much scrutiny, and after having been certified to contain nothing *contra fidem aut bonos mores,* to be printed with *Con licenza di Superiori* on the title-page.

At the same time, I do not at all mean to assert that scrutiny was unnecessary in regard to the scientific works of this period; for although they did not often contain anything *contra fidem,* they very frequently did contain a good deal *contra bonos mores,* in the form of invocations wherewith to raise a familiar demon, recipes for love philtres, and for ingenious draughts for ridding wives of jealous husbands, while the more philosophical "Elixir Vitæ" sometimes required the blood of a new-born babe. I recently met with an alchemical MS., evidently of some rarity, for it was written on vellum, and the binding showed that it had once been in the library of a Doge of Venice: *Recipe Sanguinis Humani* were the first words that presented themselves to the eye. Again, Beguinus says: "*Recipe quantitatem satis magnam sanguinis virorum sanorum, in flore ætatis constitutorum, pone in vase circulatorio, justæ capacitatis, in B. M. continue bulliens, donec draco propriam caudam devoraverit.*" So that, after all, Alexandre Dumas has not given us such a very exaggerated character in the person of the Alchemist Althotas in his "Mémoires d'un Médecin." As to the matter of remedies, I find the following in an MS. in the Sloane Collection (probably so late as the first half of the 17th century): "Rock-crystal, mixed with sublimed arsenic, is an excellent medecine; in fact, you need not any other medecine . . . . it being taught a witch by a demon, named Rachiel, who was of ye order of Cherubins." The quaintness and *naïveté* of this assertion are quite refreshing; now, whether "you need not any other medecine" because the remedy had the sanction of both a witch and a demon, or because powdered rock-crystal and sublimed arsenic had been found by the asserter to be peculiarly adapted for internal administration, we will not pretend to decide; but, surely, so-called scientific books sometimes required examination in the age of the priest Antonio Neri.

Let us, now that we know something of its author, turn our attention to the MS., *Estratto del Libro, segniato A; di Prete Antonio Neri.* There is good reason to believe that the matter of this MS. was extracted by some seventeenth-century chemist from a larger MS. of Neri, of which he speaks in the preface to "L'Arte Vetraria," and which he had intended to publish had his life only been spared.

The text is Italian, but the work cannot be said to be "writ in choice Italian;" it is rugged, and, of necessity, full of technical terms, and it sometimes passes into a curious kind of Latinized Italian. As to the contents,

we have extracts from five of Neri's books: from the book *segniato* A, 155 pages; from B, 78 pages; from D, 5 pages; from E, 13 pages; and from F, 6 pages. Between E and F are inserted 26 pages of "Operationi Copiate da un libro antico qui in Pisa;" also 8 pages about the *Green Lion*, and 10 pages of extremely mystical and unintelligible matter, replete with symbols and Arabic words concerning a certain *Donum Dei*.

An account of the subject-matter of the extracts from the book designated A will, I think, give a fair idea of that of the whole MS. In the first place, we have an account of mercury, to which metal is assigned no less than thirty-five different names, and twenty-two symbols. The Eastern element, then very apparent in chemistry, is noticeable in such names as Chaibach, Azoch, and Baruchet. Various *fisationi* of mercury are described, and the formation of some of its compounds. Gold and silver are next discussed; the latter has fifteen names and ten symbols. The fixation and calcination of gold, the calcination of silver, the solution and tincture of silver, and the conversion of silver into gold are then described. Venus (copper) follows, among the fifteen names of which are Tubalchain, Marchaal, and Cobon, but not Cuprum, or Orichalcum, or Æs Cyprium, which is surprising. Then come iron, lead, and tin; then vitriol, which has seven symbols; sal-ammoniac, which has fourteen symbols; sulphur, which has sixteen; arsenic, antimony, sal-alchali, sal-alembrot, sal-tartaro, sal-anticar, and cinnabar. The extracts from book A are concluded by accounts of the calcination of various metals, of the philosopher's stone, and of the work of transmuta ion. The short extracts from the other books contain matter of a similar nature; various well-known salts are described, together with new and varied modes of making them; and different solutions of the metals, compounds, and operations.

The ideas suggested by this MS. are manifold. We can but be struck by the excessive complexity of chemistry at this period. When a substance possesses more than thirty distinct names, and more than twenty symbols, and when these are used indiscriminately in one sentence, some idea may be formed of a chemical treatise of two centuries and a half ago. Symbols were used lavishly, not alone to express substances both simple and compound, but for operations and instruments. But the alchemists and old chemists had a special object in preserving the mysticism out of which their science had sprung, and which still, as a thick vapour, shrouded it in obscurity. Their precious *secrets* would otherwise have been at the command of the vulgar, and the result of their years of toil would have been sown broadcast over the world. The true science was but just beginning to loom through the darksome mists which surrounded it. At this time the science was made up of alchemy and iatro-chemistry, with a strong flavour of Kabbalism. As to the matter itself, we find in the works of the period scarcely anything more than had been enunciated by Geber some eight centuries earlier; in fact, there was too much beating about the bush to allow of any real progress. Antonio Neri was a somewhat sensible chemist for the period. His leanings towards alchemy were not excessive; he was not a violent Paracelsian; indeed, he was rather a metallurgical chemist than an iatro-chemist.

Such is a brief sketch of an MS., the matter of which, in a completer form, the priest Antonio Neri had intended to publish had his life been longer spared. Whether the original MS. exists we know not. Perchance it may be hidden in some old monastic library among volumes of Canon Law and countless folios of Middle Age Casuistry; perchance in some dusty nook *in Ædibus Vaticanis*, among the thunderbolts of a past Hierarchy. Who can tell? Oh! if some Sovereign Pontiff would issue a mandate apud S. Petrum sub annulo Piscatoris," to command the cataloguing of the library of the Vatican, how would not Literature, and Science, and Art be benefited by the means! and how would not Italy receive yet greater honour as the focus from which emanated the glorious light of Western civilization!

GEORGE FARRER RODWELL

CATLIN'S AMERICAN GEOLOGY

The Lifted and Subsided Rocks of America, with their Influences on the Oceanic, Atmospheric, and Land Currents, and the Distribution of Races. By George Catlin. (London: Trübner, 1870.)

IN this free-speaking record of what Mr. Catlin has seen of American geology, and of his interpretation thereof, we have the results of strong observational powers and of limited scientific knowledge, stated earnestly and ruggedly, with a faithful adherence to what was first mastered in books, and to the views of nature that early teaching gave. Such works are not rare, but they are not often noticed at large, unless, as in this instance, the author's individuality, sincerity, and earnestness are true and striking. We find in this book on the "Rocks of America" that the author believes, first, in the hypothetical granite of a primæval world; secondly, in a "schistoze zone, quite around the globe, and undoubtedly more or less an open and defined fissure between the two systems" of granite below and "sedimentary formations" above (p. 81); thirdly, "that these vast sedimentary beds, underlying secondary rocks on almost every portion of the globe, have been laid by the agency of water, with the disintegrated particles of granite, and by some (as yet mysterious) process become solidified and crystallised much in the same form, and certainly with the same ingredients, as the granite from which they came" (p. 80). It appears, also, that these low-seated sediments comprise the "azoic and palæozoic rocks" of books; "that the remains of rhizopod and algæ life [*sic*] may be found below gneiss" (p. 140), but not in the limestone in the gneiss; that the acceptation of the Laurentian system of rocks, as worked out and explained by the Geological Surveyors of Canada, is to be deprecated; that the Laurentian limestones have been deposited in "the caverns formed underneath submarine mountains, which are free from all currents of the ocean, by the infiltration of water from the overlying calcareous rocks;" "that in these caverns the first movements of organic life (which could not have existed exposed to the currents of the ocean) began;" and that these limestones were thus "imbedded, and in horizontal strata, beneath azoic rocks, and containing the '*Eozone Canadensis*' [*sic*], and other rhizopod remains which have excited so much attention of late, and been ingeniously used to undermine the

established system of geological formations" (p. 141). Fourthly, "that the granite crust, though cracked at various points, from contraction on cooling, has a limit to which those rents descend, below which, from intense heat, and the hasty and unindurated state that the external border of the molten mass must be in, the contraction has not taken place; and being in an arched shape, and resting on a liquid far more buoyant than water, that no fracture of the crust to the surface of the igneous mass has ever taken place, and that no amount of matter could be concentrated on the surface of the earth to produce that effect" (p. 82). Fifthly, that what any geologist would recognise as the *débris* of broken granite decomposed in place, Mr. Catlin refers to eruption from his subterranean granite crust, thus:—"In the Rocky Mountains and the Andes granite is very rarely seen, and when met (at the mountain's base, as it most often is, or on its summit), it is uniformly seen in amorphous masses of various sizes, with shapes plainly telling its history, that it has been shattered and torn from its bed by subterranean explosions or other disturbance, and lifted by (or has followed) the rising mass to the summits of the highest mountains, and flowing out from these, is found at the mountain's base, where it has rolled, while the mountain's top is gneiss" (p. 86). Sixthly, that water, getting to the molten mass below the author's granite, has expanded, and not only erupted the granitic boulders, but blown out great cavities, into which vast areas of surface (as the Mexican Gulf and Caribbean Sea) have fallen, making catastrophes, and leaving "subsided rocks"; whilst elsewhere the cavern-roofs have been held up as "lifted rocks." Seventhly. That the mountain floods rush into and along these cavities, leaving but little to reach the plains (p. 11); that such "submontagne currents" as these, "heated by the volcanic furnaces they have passed" (p. 4), rush out into the Caribbean Sea, and make the Gulf Stream. Eighthly. The Caribbean subsidence deluged the whole Antilles and many Aztec cities, dispersed some of the aborigines among the heights of Mexico and the Rocky Mountains, and sent some Caribs to Guiana, Venezuela, and Honduras, whilst others were transported to Florida, Newfoundland, and Scandinavia, in frail craft on the broad back of the new-made Gulf Stream, that still favours us with such of nature's blessings as it has to give.

Though not always urging his own suppositions without some doubt, Mr. Catlin is dogmatic enough in condemning the present views of ethnologists and geologists when not coincident with his own, as must be too often the case, judging from the foregoing exposition of the main points of his baseless and inconsistent hypothesis.

"I was born in the midst of the Apalachian Ranges, and amongst them spent my hunting and fishing days; and neither there nor in twice crossing both the Rocky Mountains and Andes chains, have I seen anything but the sedimentary and volcanic rocks, excepting here and there beds of shoved-up boulders of granite, raised in the manner already described." Thus the author writes at p. 92; and the mountain-life in youth and hard travelling in middle age, here indicated, are as plainly shown forth in the curious book before us, as a very imperfect geological knowledge is shown by the latter part of the sentence and its explanations as found at other pages.

Mr. Catlin's love of wild scenery, his recognition of the wonderful and mysterious in nature, his limited range in modern geology, his adherence to some old theories, his disapproval of later geological discoveries, and his assumption of hypothetical notions that have sprung up in his own active, wondering, and impressible mind, clearly witness that, "as a reader of geological works, and a spectator of many stupendous orographic structures" (p. 200), he has been self-taught on a very limited basis of natural science. Nevertheless, he conscientiously believes that he offers something towards the explanation of the geographico-geological structure of America, and of the history of the human millions who have inhabited those broad lands, with strange lives and languages, and have either disappeared for ever or have left degraded remnants, still decreasing under the deadly influences of the European. The world knows how warmly and persistently Mr. Catlin has laboured for the benefit of the Indians; not merely preserving their traditions and scraps of history, their languages, religions, customs, and features, but in damming back, if possible, the evils that befall them from their Christian neighbours. He has, indeed, spent the greater part of a long and toilsome life in helping them directly or indirectly; and the remembrance of their unfailing hospitality and kindness is with him in striking contrast with the treachery and cruelty they have suffered, and with the indifferent treatment he has himself received from his own people in the matter of Indian research, as detailed at pages 190 *et seq.* and in the Appendix.

T. RUPERT JONES

THE MODERN BUDDHIST

The Modern Buddhist: being the views of a Siamese Minister of State on his own and other Religions. Translated, with remarks, by Henry Alabaster, Interpreter of H.B.M. Consulate-General in Siam. (London: Trübner and Co., 1870.)

THIS is an extremely interesting little book. The minister whose views it records—Chao Phya Thipakon—conducted the foreign affairs of his country from 1856 till two years ago, when he was stricken with blindness and was obliged to retire into private life. It was then that he published the work—"a book explaining many things"—the more important parts of which are here translated. We need scarcely say that, looked at from our point of view, some of his beliefs are sufficiently strange, and that he sometimes expresses opinions on subjects which are altogether beyond the range of science. At the same time he has in many respects advanced far beyond the great mass of his co-religionists. He will accept nothing merely because it has been handed down by tradition, but demands proofs which will stand the test of rigid examination. In endeavouring to explain such phenomena as rain, epidemic diseases, the tides, &c., he will have nothing to do with spirits, good or bad; he takes his stand on observed facts, and although his explanations may sometimes be inadequate, they are generally quite in the spirit of modern Western investigation. So far as he understands them, he heartily accepts the European doctrines of astronomy. All this strikes a European reader as very incompatible with certain aspects of the

Buddhist religion; but Chao Phya Thipakon is convinced that Buddha knew quite well the truth about the real order of the world, and that he accommodated his language to the prevailing conceptions of his time, only that he might be the more free to proclaim his doctrines on higher subjects. Hence it is proclaimed lawful for a modern Buddhist to open his mind readily to all the results of modern research. Some of the semi-religious customs of his countrymen the ex-minister rationalises in a most amusing way. For instance, the beating of gongs and firing of guns which take place on the occasion of an eclipse, are by no means what they are generally represented—an effort to frighten the dragon who holds the sun in his jaws, so as to make him drop it; they are the expressions of the popular pride and pleasure that the mathematicians of the country are able to predict the time when the eclipse shall occur! With the strictly theological portions of this book, we have, of course, nothing to do here; but we may state that in comparing the different religions of the world with his own, Chao Phya Thipakon is as far removed as possible from a fanatical spirit. He expounds his views calmly, and appears always ready to accept new light from whatever quarter it may come. The objections he raises to the Christian theory of the world betoken a thoughtful and inquiring mind, although, unfortunately, those from whom he derived his ideas of Christianity seem to have been exceptionally poor representatives of their cause. The ethical conceptions of the book are generally of a very noble character. In one point—the proper treatment of the lower animals—the writer, of course, carries his doctrine too far, and he certainly bases it on grounds with which Westerns can have no sympathy; but there can be no doubt that he is practically far nearer the truth than the great mass of Europeans of our own day. On the whole, this book may be accepted as a good omen for the future of the East. It proves that amongst the best minds a genuine spirit of inquiry has been aroused, and that the old cosmogonies and superstitions are already beginning to give way before more scientific conceptions of man and the world.

OUR BOOK SHELF

How Crops Feed: a Treatise on the Atmosphere and the Soil as related to the Nutrition of Agricultural Plants. By Samuel W. Johnson. (New York: O. Judd and Co.)

MR. JOHNSON'S earlier treatise, "How Crops Grow," has been rendered familiar to the English public through Messrs. Church and Dyer's admirable edition, and forms a complete manual of the structure and physiology of the plant, treated in a manner specially adapted for agricultural students. The present work is intended as a companion treatise on everything connected with the nutrition of plants. The subject divides itself naturally into two sections, the first relating to the atmosphere, and the second to the soil, as sources of the food of plants. The question whether plants derive their nitrogen direct from the free element in the atmosphere was long a vexed one among physiologists. Mr. Johnson details the experiments which were thought to favour the argument on both sides, giving the preference, and we think rightly, to the later researches of Boussingault, and those of Lawes, Gilbert, and Pugh, which appear to demonstrate that the enormous quantity of free nitrogen in the air is not available for the food of plants; but that they draw their supply of it from the extremely minute quantities of ammonia and other nitrogenous compounds that form an essential ingredient of the atmosphere. Under the head of water as an element in plant-food, we miss any reference to the recent important researches of Dehérain, which show that the evaporation of water from leaves is determined entirely by light, and by those rays only which are efficacious in the decomposition of carbonic acid, and that it may proceed in a perfectly saturated atmosphere. This omission will probably be supplied should an English edition be published. The second portion of the work relates to the soil as a source of food for plants, and is the one which will be of special interest and value to practical agriculturists. Here we find treated in an exhaustive manner the origin and formation of soils, the kinds of soil, their definition and classification, their physical characters, and the soil as a source of food to crops, including those ingredients whose elements are of atmospheric origin, and those whose elements are derived from rocks. We can do no more than recommend to the notice of those interested in agriculture a work which we believe will be found a reliable handbook to that scientific knowledge in which the bulk of English agriculturists are at present so lamentably deficient. The most scientific of all manual occupations is actually conducted on a system which is a mixture of complete empiricism and unscientific theory.

Reflections, Historical and Critical, on the Revival of Philosophy at Cambridge. By C. M. Ingleby, M.A., LL.D. (Cambridge: Hall and Son, 1870.)

IN this *brochure* of some eighty pages, after tracing the origin and fortunes hitherto of the Moral Science Tripos at Cambridge, Dr. Ingleby seeks to gauge the efficiency of its present constitution by a threefold test; reviewing the selection that has been made of examiners, the prescription that is made of books, and the composition of some examination-papers lately set. It is shown how, more than thirty years ago, when philosophy was all but extinct in Cambridge, Sir William Hamilton, of Edinburgh, in vehemently (as his manner was) attacking Dr. Whewell's views of the prerogative character of mathematics in a liberal education, threw out the idea of a Moral Science Tripos, which sixteen years later it was reserved for his contemptuous opponent himself to carry into effect. So established, how coldly the new Tripos was, and has continued to be, looked upon by the dispensers of College favours, is next brought out with much evidence. In the choice of examiners, the remarkable fact is the preference shown for men not distinguished in the Tripos itself; two only, out of forty-six first-class Moral Science men within the ten years from 1851, having later been entrusted with the examining function! But it is in the list of books prescribed and in the examination-paper that Dr. Ingleby finds most scope for criticism. As regards books he is angry, not without reason, at the omission of certain works, and angrier, for reasons sometimes oddly expressed, at the inclusion of certain others; in the end, he would appear not greatly to mind if, among moderns before Kant, for the sake too of Kant, Hume only were retained. The questions set on modern philosophical systems seem to him "mere *aperçus* of outsiders," seldom showing true intellectual mastery and grasp.

Dr. Ingleby is always lively in his narrative, often forcible in his criticism, and more than once, when he becomes personal, a little violent. To English thinkers all round he administers raps on the knuckles with much impartiality, but the full weight of his cudgel is for the backs of Mr. Mill and Prof. Bain. He may be said to write as a disciple of Kant (with more or less of outlook towards Hegel); and every true student of mental science will be with him in his wish to see the great father of German philosophy really and at first hand acknowledged in Cambridge. When, however, his enthusiasm carries him to say that no philosophy that does not derive from Kant is able to explain the

apodeictic judgments of mathematics, and that to Cambridge men other (all other?) thinkers waste their breath, the saying seems strong. Not to say that Cambridge mathematicians do not always seem to Dr. Ingleby an unexceptionable court of appeal in matters of philosophy, one does not see how they should be above listening to other philosophical doctrine any more than their German brethren. The illustrious mathematicians of this century in the country of Kant have not been noted for their readiness to accept his view of the philosophy of their science. G. C. R.

Die Zonula Ciliaris. Habilitations-schrift von Dr. Fr. Merkel. (Leipzig: Engelmann. London: Williams and Norgate.)

IN this little pamphlet the author attempts to disprove the existence of the "Canal of Petit." He describes the Zonula itself as a band, triangular in section, which passing over from the summits of the ciliary processes to the lens capsule embraces the edge of the lens, and becomes attached to both its anterior and posterior surfaces. The fine fibres of which the band itself is composed are in the anterior portion somewhat stouter, and joined together by an imbedding substance so as to form a membrane which offers abundant resistance to post-mortem changes. In the posterior portion the fibres are tender, free from any connecting substance, and very speedily break up after death; they thus readily give way before insufflation or injection, and the cavity or canal thus artificially produced in the posterior portion of the zonula is that which is known to anatomists as the canal of Petit. M. F.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

The Gulf Stream

NOTWITHSTANDING the mistakes in the botanic names in Mr. Groom's letter, forwarded to you by Mr. Gray, there is no difficulty in identifying the leguminous seeds alluded to. There are several different kinds which are certainly brought by the Gulf Stream from the West Indian Islands, and the countries round the Gulf of Mexico, as the plants producing them are common in Jamaica, Honduras, Guiana, &c. They comprise the horse-eye bean (*Mucuna urens*), the sword-bean (*Entada gigalobium*), the *Mimosa scandens*, Linn., *E. Pursatha* (*M. scandens*, Roxb.), and the antidote cacoon (*Feuillea scandens*). They are sometimes drifted on shore in the seed-pod, but usually the seed alone.

In an article "On some Economic Uses of Nuts and Seeds," in my *Technologist* (vol. iv., p. 339), I alluded to several of the applications of these seeds, but the superstitious one referred to by Mr. Groom is new to me, although the setting the horse-eye beans in silver is very common for bracelets, &c.

P. L. SIMMONDS

The Intended Engineering College

YOU were good enough to publish in NATURE for the 18th of last month, a letter in which I stated what appear to me to be serious objections to the foundation by the Government of a special college for the education of engineers for the Indian Service. Last week's NATURE contains a letter on the same subject from Mr. W. Mattieu Williams, to which I certainly should not think it needful to reply if my personal opinions only were the subject of discussion; but, as the matter on which I ventured to address you is one of public importance, and was treated by me as such, I must ask you to insert a few additional remarks.

The objections to the Government scheme which I have urged in my previous letters were two: first, that the creation of a Government College, which would compete on unequal terms with the principal scientific schools of the country, would be an injury to science; and, secondly, that, leaving the interests of science out of the question, it would be an improper way of spending public money.

Mr. W. Mattieu Williams's way of disposing of these objections is simple, if not very conclusive. It is, to take no notice whatever of the second (which is, perhaps, not surprising, seeing that it is only Indian and not English public money which it is proposed to throw away), and to meet the second with what is, at best, a *petitio principii*. Beginning with the assertion that I complain "on most narrow and unreasonable grounds" of "a supposed intention of the Government to aid the teaching of science"—whereas what I do complain of is the supposed intention of Government to do what I believe will have the exactly opposite effect—he devotes the greater part of his letter, not to showing that my view of the probable effects of the Government scheme is wrong, but to a "protest against the principle upon which Mr. Foster's complaint is based." According to Mr. Williams, this principle is, "that Government must initiate no scientific effort, give no special aid or patronage to any college or scientific institution, lest it should assail the vested interests of 'institutions like University College and King's College in London, and Owens College in Manchester.'"

I will not follow Mr. Williams through his vigorous commentary upon this text, and will only remark, in the first place, that my "complaint" was limited to the particular case of the Government entering into competition with private institutions, to do exactly what they are doing, without reasonable expectation of being able to do it better; and, in the second place, that the ground upon which my complaint of such competition was based was, that it would tend to hinder the spread of scientific education. The fact that my own interests and those of my college may be more or less affected if the Government scheme is carried out, might be a ground of private regret, but it certainly would not have been a reason for asking public attention to the scheme through your columns. On the other hand, I do not consider it as a reason for being silent in regard to a matter which, as I believe, concerns the interests of science and of the public.

One word more. The procedure of the Government in this matter, without previously taking the advice of visible and responsible scientific advisers, is a sample of a mode of conducting public affairs which, it appears to me, is the most serious disadvantage of a public kind under which science in this country has to labour. What we want, even far more than the expenditure of more money upon scientific objects, is some system which should assure us that what is spent in the name of science is spent for the greatest advancement of science, according to the best judgment of the most competent authorities.

G. C. FOSTER

University College, London, Sept. 5

Hollyberries and Birds

IN reply to Mr. Reeks's question, where his opinion as to the relations between birds and berries seems to differ from Mr. Darwin's, I think it best to allow the latter to speak for himself. At page 240 of "The Origin of Species" (fourth edition), after alluding to the part that insects play in the fertilisation of flowers, by their "unconscious selection" rendering them conspicuous and beautiful, he continues: "A similar line of argument holds good with many kinds of beautiful fruits. That a ripe strawberry or cherry is pleasing to the eye as to the palate, that the gaily-coloured fruit of the spindle-wood tree and the scarlet berries of the holly are beautiful objects, will be admitted by everyone. But this beauty serves merely as a guide to birds and beasts, that the fruit may be devoured and the seeds thus disseminated. I infer that this is the case from having as yet found in every instance that seeds which are imbedded within a fruit of any kind, that is within a fleshy or pulpy envelope, if it be coloured by any brilliant tint, or merely rendered conspicuous by being coloured white or black, are always disseminated by being first devoured." And again ("Variation under Domestication," vol. ii., p. 230): "The white Tartarian cherry, owing either to its colour being so much like that of the leaves, or to the fruit always appearing from a distance unripe, is not so readily attacked by birds as other sorts. The yellow-fruited raspberry, which generally comes nearly true by seed, is little molested by birds, who are evidently not fond of it; so that nets may be dispensed with in places where nothing else will protect the red fruit ('Bull. de la Soc. d'Acclimat.,' tom. vii., 1860, p. 359). This immunity, though a benefit to the gardener, would be a disadvantage in a state of nature both to the cherry and raspberry, as their dissemination depends on birds. I noticed during several winters that some trees of the yellow-berried holly, which were raised from seed from a wild tree found by my father, remained covered with fruit, whilst not

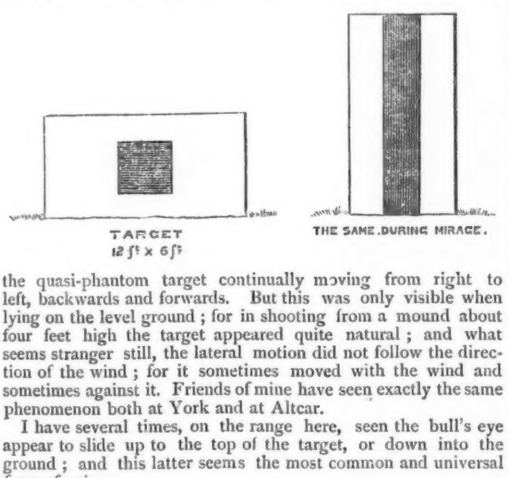
scarlet berry could be seen on the adjoining trees of the common kind. A friend informs me that a mountain ash (*Pyrus aucuparia*) growing in his garden bears berries which, though not differently coloured, are always devoured by birds before those on the other trees. This variety of the mountain-ash would thus be more freely disseminated, and the yellow-berried variety of the holly less freely, than the common varieties of these two trees." It appears to me that a hollyberry falling by its own weight from the bush would be borne vertically downwards; and though nourished by a soil impregnated with the decayed leaves of the parent tree, the young plant would be almost entirely deprived of light, and would soon succumb to its more vigorous rivals in "the struggle for existence." Perhaps in a country where but little land is left uncultivated, "the great majority" of seeds transported by birds "would be deposited on arable or pasture land," and thus succeed no better than the others; but so far as my limited experience extends, the most usual positions in which seedlings of the holly naturally spring up, seem to be at the bases of steep rocks or of trees whose branches are not sufficiently low and spreading to exert an unfavourable influence. If Mr. Reeks's speculations be correct, they appear to me to point to the ultimate extinction of the species in a state of nature rather than to its gradual modification.

W. E. HART

Mirages

THE reading of the two letters of your correspondents in the last number of NATURE has called to my mind the fact, which may not be generally known to your readers, that mirages are of frequent occurrence (and I need not add annoyance) to riflemen, especially "small-bore shots."

The most remarkable case of which I have heard was seen at Wimbledon, during the meeting of the National Rifle Association, in July last. The target at the 1,000 yards range is of an oblong form, 12 ft. wide by 6 ft. high, and with a bull's-eye three feet square. On lying down to shoot on the level ground, the target appeared in a reverse position, with the bull's-eye running through the entire height, from top to bottom, thus—



TARGET 12 ft x 6 ft THE SAME DURING MIRAGE.

the quasi-phantom target continually moving from right to left, backwards and forwards. But this was only visible when lying on the level ground; for in shooting from a mound about four feet high the target appeared quite natural; and what seems stranger still, the lateral motion did not follow the direction of the wind; for it sometimes moved with the wind and sometimes against it. Friends of mine have seen exactly the same phenomenon both at York and at Altcar.

I have several times, on the range here, seen the bull's eye appear to slide up to the top of the target, or down into the ground; and this latter seems the most common and universal form of mirage.

I need not add, that in all these cases the sun-light was intense.

W. PERCY SLADEN

Halifax, Aug. 29

Kant's Transcendental Distinction

HAD I cherished the wish to involve Mr. Mahaffy in a war of words (λογοθηρία), so often degenerating into a war *about* words (λογομαχία), his straightforward and sensible letter, *wreathed* with courtesy and generosity, would have extinguished it. But, with some desire to justify my own censure, I had no such wish; and now that I know exactly what he had in mind, in the examination question, as in the note on page 57 of his work, I will say my say as briefly as possible on his view of Kant's "distinctions."

I thought, and still think (and here the learned translator of Fischer, has misapprehended me), that Kant intended to contrast *general* Sense (not particular sense, as colours, odours, &c.) with Understanding. Otherwise, the repeated reference to "Herr von Leibnitz" would be unintelligible. (See Hartenstein's Ed. of the K. r. V., p. 241 *et seq.*) To suppose, as Mr. Mahaffy suggests, that something more recondite, something quite radical was meant by Kant, seems to me a gratuitous refinement; for *a priori* elements of sense, as those of understanding, are *transcendental*; and the distinction would have only a *logical* difference; or, in Kant's language, it would be a distinction of logical, not of transcendental, reflection. No one, I am sure, knows better than Mr. Mahaffy, that all transcendental *distinction* is the result of transcendental *reflection*; and to this the doctrine of Time and Space is a necessary preliminary; that doctrine, therefore, is not based on the transcendental distinction. I cannot doubt that Kant called the generic distinction between the two faculties (Affection and Function) *transcendental*, not because he was contrasting transcendental elements, but because the distinction was drawn by *transcendental reflection*; *i.e.* reflection which, by the vantage of a transcendental ποῦ στῶ, refers a conception to this or that faculty.

Accordingly, we are not called upon to give a more recondite meaning to the distinction in question in order to explain the use of *transcendental* as applied to it. Rather let us bear in mind what Dr. J. H. Stirling pointed out to me some months ago, that Kant somewhat loosely applies that adjective to other matters besides the *a priori* elements of experience. In fact, he applies it to the said *distinction* and *reflection*, and also to the thing in itself, an object exercising an unknown function, feigned to account for a known state. The unknown function indeed might be called transcendental, but the object is in itself a mere nullity. If Sensation be referred to the *kick* (as Dr. Stirling calls it) received by us from the feigned object, that *kick* is transcendental; but "das Object bleibt uns unbekannt *und transscendente*." We say, then, that the two forms of sense and the four forms of thought (in apperception) are *transcendental and constitutive of experience*; but the object in itself is *transcendent* and *regulative of thought*. If Kant departs from his own nomenclature in the case of the noumenon, we need not be surprised if he does so in the case of the distinction between sense and understanding.

The bearing of this question on "Kant's View of Space" (which was the topic of controversy between Mr. G. H. Lewes and Dr. J. J. Sylvester in the columns of NATURE) is noteworthy here. The sensibility, according to Kant, is not spontaneous or active, like the understanding. The forms, then (*i.e.* the institutions of Time and Space), are not, cannot be, products of the *activity* of any faculty, and therefore time and space cannot be forms of *Thought* in any legitimate sense of the word. Let it be used in the widest sense possible; let it stand for *the active faculty of mind in general*; and then it can be proved that Kant would have refused to refer to it the forms of general Sense, because he denied to general Sense any activity whatever.

C. M. INGLEBY

Valentines, Ilford, E., Sept. 6

Volcanic Agency *v.* Denudation

MR. DAVID FORBES holds that, in instituting "a comparison between the relative magnitude of the operations of internal and external forces in determining the main external features of our globe, we must grant the first rank to the internal, volcanic, or cataclysmic agencies, since, had it not been for their operations, our globe would have remained without any visible land for the rivers to traverse, or the rain and ice to disintegrate and wear away."

The latter part of the statement cannot, of course, be called in question. But does the conclusion necessarily follow? Suppose I say that a father who died before his son was born, ought, as far as that son's education was concerned, to rank before the schoolmaster who taught him, because but for the father there would have been no boy to teach; or that the quarryman who extracted a block of marble from the quarry ought to rank before the sculptor who shaped it into a statue, because but for the quarryman the sculptor would have had nothing to work upon. In truth, in a case like this, it is hard to attach any definite meaning to the idea of rank. If Mr. Forbes had said that in the task of bringing the earth's surface into its present shape, internal forces have done more work than external

I should have known exactly what he meant, and made bold to differ from him.

I feel sure, however, that those geologists who have endeavoured to revise the almost forgotten teaching of Hutton as to the important part played by subaërial denuding forces in forming the present surface of the ground, are by no means forgetful of the obligations they are under to upheaval for furnishing them with materials to be shaped; and in cases of great mountain chains they have always admitted that the superior elevation of the ground is mainly due to internal action, though they hold that all the sculpturing of the upheaved mass into gorge and peak is due to atmospheric agency. A. H. GREEN

79, Dodworth Road, Barnsley, Sept. 3

Geology of Devonshire

A RAILWAY of eight or ten miles is now in course of construction between Totnes and Ashburton in Devonshire. To a geologist the cuttings near the latter town are most interesting. I am not a geologist, although the science is deeply interesting to me. I returned from Ashburton ten days ago. The rocks there at one part of the line were evidently volcanic. They appear exactly as if they had been melted, and in boiling up a scum or froth had risen on the surface, and in cooling had left air-bubbles, now nearly filled with sometimes yellowish crystals. The rock is very hard, and has a stratum of what was once slate, ten or twelve feet thick, and as the workmen work it out it bears the colour which great fire would give it. As blocks of the other rock are torn out by powder, they are found to contain or enclose fragments several inches square of the superincumbent slate rock, too hard to be melted. This rock is not stratified, but breaks into any form. A few hundred yards off they are working through ironstone as hard as iron itself. The heavy sledge hammer rings on the blocks as on an anvil. At the east end of the town are two pits worked for umber, indeed there are several fields of which the soil a few inches below the surface consists wholly of umber. I do not expect there is any one in the neighbourhood who feels an interest in geology. I saw a letter in NATURE on a geological subject from Mr. Pengelly, of Torquay and I wrote him on the above subject. I have no doubt the line is very interesting in the other parts, as the rocks greatly vary thereabouts.

A learned geologist would have made what I have attempted to describe more interesting. He would find much to employ him in that neighbourhood. W. LUSCOMBE

Hereditary Deformities

IN the lessons in Ethnology in "Cassell's Popular Educator," it is stated, on the authority of Dr. Theodor Waitz, and the Secretary of the Anthropological Society, that "an officer, whose little finger had accidentally been cut across, and had, in consequence, become crooked, transmitted the same defect to his offspring. Another officer wounded at the battle of Eylau, had his scar reproduced on the foreheads of his children." And again, "In Carolina, a dog which had accidentally lost its tail transmitted the defect to its descendants for three or four generations." Do these stories rest on a good foundation? We know that congenital peculiarities of form and disposition are transmitted from parent to offspring, but that an accidental *deformity* should be so transmitted is a very different affair, and if substantiated would introduce *Accidental Distortion* as a co-worker with natural selection in the modification of species.

Faversham, Kent, Aug. 27 WM. FIELD

Poisoning by Œnanthe crocata

PERMIT me to send you the following notes with regard to the case of poisoning by *Œnanthe crocata* which appeared in your issues of 18th August and 1st September.

I. As to the poisonous properties of *Œnanthe*, Prof. Christison found that plants gathered in certain localities were harmless, while others from different places were highly poisonous.

II. As to the mode of death. This seems materially to differ from that observed and recorded with regard to poisoning with hemlock (*Conium maculatum*). In the case of poisoning with hemlock which took place in Edinburgh in 1845 (recorded in the *Edin. Med. and Surg. Journal*, No. 164, and also Prof. Bennett's "Principles and Practices of Medicine") the mind remained clear till the end, and death resulted from asphyxia produced by slow paralysis of the muscles of respiration. The muscular paralysis commenced in the feet.

In the recent case of poisoning by *Œnanthe* there seems to have been coma and convulsion for half an hour previous to death; no paralysis seems to have occurred over the body. From the account of the hemlock case to which I have referred, that plant also seems not to have any particularly acrid taste. The part that seems strange to me is the difference in the mode of death with plants so nearly allied to each other as the *Œnanthe* and the *Conium*. J. W. E., EDIN.

NOTE ON SOME INSTANCES OF PROTECTIVE ADAPTATION IN MARINE ANIMALS

THE various phenomena of mimicry and protective adaptation have recently received much attention, notably from Messrs. Darwin, Bates, and Wallace, and some very interesting facts and reasonings on the subject are contained in the recently published "Contributions to the Theory of Natural Selection" by the last-named author. It can scarcely be needful to explain at much length the nature of the phenomena in question. Well-marked instances of mimicry are not very common; some of the most surprising are those of the leaf and stick insects of the Tropics, which it is almost absolutely impossible, when at rest, to distinguish from dead leaves and twigs. The importance of these resemblances, in conferring protection from attack, will be at once evident. Commoner instances of adaptation, which may indeed be noticed wherever we turn our eyes upon the animal creation, are those of more or less complete resemblance of colour between the animal and its surroundings. The most remarkable instance of this kind which has come under my own observation is perhaps that of the caterpillar of the Emperor moth (*Saturnia pavonia minor*), which, with its green ground and brilliant pink spots, is almost undistinguishable from the heather upon which it frequently feeds.

Numerous instances of this kind amongst terrestrial animals might be brought forward, but less attention has been paid to similar points in the less highly-organised of marine animals. They are, for the most part, much less easily observed in their natural haunts, and their habits and the dangers to which they are exposed are of necessity imperfectly understood. We may note, however, that fishes very commonly assume the colours of surrounding objects; the flounder is almost exactly of the colour of the sand on which it lies, and fishes which bask amongst groves of seaweeds are often of brilliant and variegated colours corresponding very much with the vegetation around them.

The two instances which form the subject of this notice came under my observation while dredging in June last in the Frith of Clyde. In one spot the dredges brought up many plants of *Laminariæ* with their roots, which consist of a conical mass of contorted and intertwined fibres about a line or two in diameter; amongst these were imbedded quantities of nullipores—a calcareous seaweed of the genus Melobesia—(*M. calcarea*). The larger weed had, in fact, grown in a bed of the nullipore, which came up abundantly in the dredge, and indeed now forms on a closely adjacent part of the coast a raised beach of several feet in thickness. Amongst the nullipore which matted together the laminaria roots were living numerous small starfishes (*Ophiocoma bellis*), which, except when their writhing movements betrayed them, were quite undistinguishable from the calcareous branches of the Alga; their rigid, angularly-twisted rays had all the appearance of the coralline, and exactly assimilated to its deep purple colour, so that though I held in my hand a root in which were half a dozen of the starfishes, I was really unable to detect them until revealed by their movements.

The second instance is that of a shellfish, *Lima hians.* This beautiful mollusc is well known frequently to construct for itself a nest—a long tube lined with byssal fibres and covered externally, after the manner of a caddis-worm, with nullipores, stones, old shells, or probably any material which lies conveniently at hand. We may perhaps account for a habit so different from that of other mollusca by the following considerations:—

The animal is an exceedingly showy one, more so than almost any other British mollusc, having two valves of snowy white, from between which are protruded long tentacular fringes of a brilliant orange or vermilion hue; when alarmed, it darts, or almost, as one might say, flies, in a fitful manner through the water, showing its gorgeous colours very conspicuously—so that indeed in the Channel Islands it has acquired the name of "Angel's Wings." Other mollusca, such as some of the Pectens, are brilliantly coloured, and live without the protection of any nest, but their shells are very strong and close firmly, so that they could not easily be masticated by ordinary fishes. The shell of the Lima, on the contrary, is very fragile, and would easily be dealt with by fishes which are accustomed to devour wholesale crabs and other hard-bodied creatures. It is, therefore, easy to believe that the two characters of tenderness and brilliant colouring would speedily ensure the extinction of the species were it not protected in some extraordinary manner such as that of the concealment afforded by a nest. Mr. Wallace has shown, in a very interesting manner, how birds of brilliant plumage build nests of a character adapted for concealment during incubation, and it seems to me that the similar habit of the Lima may probably be referred to the same cause.

GEORGE S. BRADY

SWALLOWS' NESTS*

A FEW months ago M. Pouchet published an article on the subject of swallows' nests, which seemed destined to modify all our previous ideas of reason and instinct. According to this naturalist, the common swallow had modified his habits, and had made certain progress in the art of nest-building.

Had this theory been correct, we must have renounced our preconceived notions which place an insuperable barrier between reason and instinct. If we assume instinct to be a faculty incapable of development, and not progressive in the animal, it is clear that if any modification or progress were once scientifically proved to have taken place in the arts of which each animal is capable, it would be necessary henceforward to classify such arts as appertaining to the domain of reason.

The communication, therefore, made by M. Pouchet to the Académie des Sciences would have had great weight had the facts which it related been confirmed by subsequent observation.

Such, however, does not seem to be the case, for M. J. B. Noulet has recently pointed out the error contained in M. Pouchet's statement.

According to M. Noulet, there are two distinct varieties of swallows, the window swallow (*Hirundo urbica*, of Linnæus), and the chimney swallow (*Hirundo rustica*).

These two types do not intermingle, and have somewhat different habits; for instance, the chimney swallow is always the first to arrive and the first to leave these countries. Their nests are also different, and the difference is so well marked that there need be no difficulty in deciding as to the builders who have constructed them.

The city swallows (*H. urbica*) always choose the lofty situation, and group their nests in continuous lines, sometimes double and even triple. The *H. rustica*, on the other hand, establishes itself lower down, and constructs its nest apart from its fellows. The nests, too, of the first-named variety are chiefly distinguishable by a greater depth, and by a circular aperture just large enough to allow the bird to go in and out without difficulty.

M. Pouchet, paying no attention to the difference existing between the two varieties to which we have alluded, takes the nests of the city swallow for those of this rustic sister brought to a higher degree of perfection.

This, at least, is M. Noulet's opinion. It remains to be seen if M. Pouchet will accept the explanation, or whether he will be prepared to defend his own theory. In either case the readers of this journal shall be informed.

ALFRED NAQUET

* "Nos deux hirondelles et leurs nids." Par J. B. Noulet.

FACULTY OF SCIENCE IN UNIVERSITY COLLEGE

SOME months ago it was announced in our columns that a Faculty of Science had been formed in University College. In the prospectus now issued for the forthcoming session there appears the following general statement:—

"The Faculty of Science has been instituted to bring into full light the actual extent of the scientific teaching in University College, and to meet, consistently with sound educational principles, the growing demand for instruction in science.

"The Faculty of Arts in University College, instituted to give a general training in literature and science, such as is required for a degree in arts in the University of London, not only has from the first contained chairs in which the scientific instruction has been developed far beyond the needs of arts-students, but by a steady process of growth has come to include others bearing no relation to an arts-curriculum. So considerable is the scientific staff now actively at work in the college, that the authorities believe the time has arrived when the science-teaching carried on within its walls may assume all the character of independence and dignity associated with the academic title of Faculty.

"The demand for instruction in science and the recognition of science in education are facts beyond question. In University College itself the number of students seeking a broad scientific training or pursuing special scientific studies has gone on steadily increasing; while in the University of London and elsewhere, degrees in science, both general and special, have been conferred for some years past. The importance, also, of science as a preparation for industrial pursuits is now generally acknowledged, as appears in the efforts that have been made of late years to supply scientific instruction in so-called technical schools.

"The main principle represented by the new Faculty is, that science should first of all be cultivated for its own sake, and that even where there is a practical object in view, a broad foundation should be laid of general scientific training. It is believed that the habits of thought thus engendered are the first conditions of all true advance, either in scientific discovery or in practical invention. A second principle is, that the pursuit of science should not be divorced from literary culture; and this the Faculty, from its position in University College, is specially enabled to uphold. As regards the interpretation of the word Science, it only remains to add that this is taken in no narrow sense. Certain subjects are included which lie out of the sphere of Natural Science, as commonly understood, but none that do not admit of a strictly scientific treatment."

As at present constituted, the Faculty includes chairs of pure mathematics, applied mathematics and mechanics, physics, chemistry, and practical chemistry, mineralogy and geology, engineering, architecture and construction, botany, comparative anatomy and zoology, physiology, practical physiology and histology, philosophy of mind and logic, political economy.

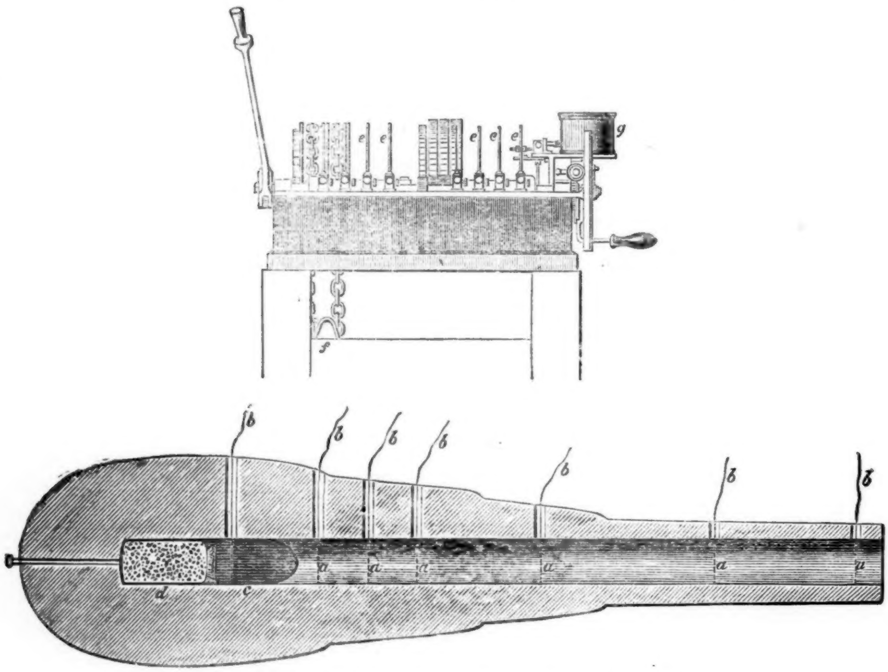
THE SCIENCE OF WAR

III.

GUNS AND GUNPOWDER

WITHIN the past twelve months an invention of considerable ingenuity has been matured which promises to enlarge to a marked degree our knowledge of the science of gunnery. We are all aware of the great perfection to which the cannon in use now-a-days have been brought, and how they represent the results of progress which has been steadily going on during three or four centuries, until at last we have succeeded in producing guns rifled to such a degree of precision that any object visible at a couple of miles may be hit with certainty, while in some cases a distance of ten or even eleven thousand yards is actually reached by the shot. These are improvements at once patent and appreciable, and such indeed as might be anticipated from constant practical and theoretical study of the subject; but while congratulating ourselves upon the advance made in this branch of gunnery science, we cannot, at the same time, but marvel at the slight progress effected towards improving the source of our motive power, and at the fact that no explosive agent has yet been brought forward to supersede the gunpowder now used.

Explosive mixtures have, it is true, been proposed from time to time, whose advent has been heralded with such high-flown praise and promises that one could not but suppose that the days of gunpowder were numbered; in



a The points at which the insulated wires are cut in the bore of the gun.
b The insulated wires leading to the induction coils and disc apparatus.
c The shot.
d The cartridge.
e Revolving discs.
f Weight for setting machinery in motion.
g Stop clock to record the number of revolutions.

one respect or another, however, the new-comer always failed to satisfy its severe military censors, and was thus thrown on one side and forgotten. Even nitro-glycerine and dynamite, of which chemists were at one time so very sanguine, have been entirely rejected for military purposes, and gun-cotton is indeed the only explosive material, besides gunpowder, to which our war authorities are inclined to give ear. The very important qualities which pyroxilin exhibits under various phases of combustion, its immense power, its portable and convenient character, and furthermore its comparative safety when in store and in course of manufacture, render it in some respects equal and even superior to gunpowder for engineering operations.

Nevertheless, at the present moment our knowledge even of gun-cotton is not sufficiently advanced to allow of its being universally employed in the same manner as gunpowder, and it is to the latter, therefore, that we must still look for the principal source of explosive power.

It appears strange that, being as it were continually thrown back upon our elementary explosive, no radical improvements should have been effected in its manufacture; we still employ the proportions of sulphur, charcoal, and saltpetre as they were laid down in the first instance by Bacon and Schwartz, and in fact so stationary has been our position in regard to the matter that it would appear almost as if perfection had long since been attained.

While, however, the chemical composition of powder has remained unchanged, some very important modifications in its rate of burning have been of late years brought about by merely altering its mechanical form and density. Indeed by thus varying its outward character, and without in any way tampering with its chemical composition, an exceedingly rapid, or on the other hand a leisurely, burning product may be secured from precisely the same materials. This means of controlling the explosive character of powder is of especial value in connection with

heavy rifled guns, in which an evenly burning product is an absolute necessity; and indeed the most important condition to be fulfilled in gunnery science is always to employ in a gun that powder which is best adapted to the arm. Now it is a well-known fact that the larger the grains of powder are made, the slower does a charge of it burn, supposing always the particles to be uniform in size, and not of a thin chip-like character, or irregular in shape. In rifled guns a slow, regular-burning powder is a *sine quâ non*, for, unlike the case of smooth-bore howitzers and mortars, a steady and increasing push, and not a violent jerk, is necessary to force the projectile through the grooves. For mortars, therefore, a comparatively fine-grain powder is employed, while for big rifled cannon a material of the coarsest description, with grains approaching in size that of a hazel nut, is invariably preferred.

The best charge for a gun, especially if rifled, is moreover that which increases in power as the shot passes through the bore, and which exerts its greatest force as the projectile leaves the muzzle, *but not earlier;* so that, on the one hand, the maximum explosive power is not put forth until the instant the mouth of the gun is reached and the last impetus given, while on the other hand no loss of power is suffered by the charge still burning after the bore is empty. If the charge burns quickly the shot is brought into action too rapidly, and the gun consequently subjected to excessive strain; whereas, if the combustion of the powder is too slow, the shot does not receive the full benefit of the charge, and a large portion of it is lost. Thus, as may easily be imagined, the difficulty has hitherto been to fix upon the precise description of charge necessary to the gun, and it is just this difficulty that has recently been solved by the elaboration of an instrument which accurately informs us of the velocity of any shot during its passage through the gun.

The possibility of discovering what takes place in the bore of a cannon at the time of its discharge, and of ascertaining how fast the shot travels, is a subject that has long attracted the attention of artillerymen, and among others that of a talented officer, Captain Andrew Noble, of the Elswick Ordnance Works. This gentleman's labours have recently been crowned with success; and an apparatus has been devised of which one hardly knows whether to admire more its exceeding delicacy or its wonderful results. With its aid the examination of gunpowder is now being conducted with comparative ease, and what is still more important, with unerring certainty.

A detailed description of the instrument, which has received the name of Chronoscope, would necessitate more space than we have here at our disposal, but its main features, and the principle upon which it is based, are easily explained. The tube or bore of a gun is fitted inside at certain intervals with metal rings (to the number of six or eight) the outside margins of which are sharpened into so many knife-edges. On a shot passing along the bore and through these rings, the edges of the latter are jammed down upon and made to cut through the ends of various insulated wires, one of which is placed under each ring. If we now suppose each of these wires to be in connection with an electric battery, it follows as a matter of course that as one wire after another is cut through, and the insulation consequently removed, an electric current passes; so that if there are six rings and wires fitted at intervals in the tube of the gun, the passage of a shot along it would be instrumental in producing six electric sparks following rapidly one upon the other.

We now understand how the shot is made to tell the tale of its flight; but there remains yet to be explained how the story is written down. This recording of the signals is accomplished by a very simple arrangement. A series of metal discs, one in connection with each wire, is made, by means of a clock-work arrangement, to revolve at a certain rapid velocity, say at the rate of 1,000 inches in a second; the surface of the discs is of polished silver, coated with lamp-black, and as soon as the desired speed has been attained, the gun, which is in electrical communication with the instrument, is fired. As the shot traverses the first ring, No. 1 wire is cut through, and a spark thereupon hops over to the recording disc, removing a little of the lamp-black covering, and thus marking the place by laying bare a minute spot of bright metal. No. 2 wire, when cut by the second ring, leaves a similar record upon another disc precisely in the same manner; and so on with Nos. 3, 4, 5, and 6, the relative position of the six spots on the six discs indicating exactly the velocity with which the shot has passed the six different rings or stations.

A very simple calculation is now necessary to get at the results; if there is a distance of one inch between each point, we know that one-thousandth part of a second has sufficed for the shot to travel from one ring to the other, for we remember that the discs were revolving at the rate of a thousand inches per second. This, however, only by way of example, for as a matter of fact we may mention that a shot usually takes from $\frac{1}{200}$th to $\frac{1}{300}$th of a second to traverse the whole length of the bore, its speed being somewhat slow when passing the first rings, and increasing as it approaches the muzzle of the gun.

A certain amount of correction is of course necessary when reading off the results, but the accuracy of these may at any time be verified. Thus, in order to ascertain whether the electric and mechanical arrangements of the discs are in good order, it would be necessary merely to place the whole number of wires together under a single ring, so as to be cut through at one and the same moment, when the points on the discs should, of course, all coincide.

The great importance of this beautiful invention need not be dilated upon by us, as the value of its aid in experiment is at once apparent to the veriest tyro in gunnery. As a measurer of time and speed of the most perfect character, its delicacy is certainly unsurpassed; for, by merely dividing every inch of the discs into a thousand divisions or degrees, we are at once enabled to calculate with precision to the millionth part of a second.

NOTES

A WEEK or two ago we announced a rumour to the effect that the Government had refused to allow a ship to convey the eclipse observers to Spain and Sicily next December. The rumour was too well founded; the Government has actually refused to tell off a ship for this purpose. This decision in the teeth of the plainest precedents requires no comment on our part; in fact, it is beyond all comment, it is astounding. We are enabled to announce, however, that the American Government, more enlightened than our own, are making extensive preparations; and upon the results of their labours and those of the Continental Governments Englishmen must therefore fall back, in a research which is eminently English. The Americans will send three corps of observation, to be stationed respectively at Malaga, Sicily, and some place in Turkey most available for making the best scientific records and views. One of these corps will be sent from the Naval Observatory, and the other two will be composed of the most scientific men in the country, including the professors from Harvard University. Before the war broke out it was arranged that Rear-Admiral Glisson should extend to the corps at Sicily all the aid and cooperation in his power. But the original plan has been spoiled for the present by the troubles in Europe, Admiral Glisson being obliged to move his squadron to the Baltic for the protection of American commerce in that vicinity.

WE regret to learn that the health of Gen. Sir E. Sabine, the distinguished and venerable president of the Royal Society, is at

the present moment such that he is likely soon to demand relief from the pressure of those duties which he has hitherto performed with so much credit.

BEFORE our next number is printed, the annual meeting of English *savants* will have commenced at Liverpool under the presidency of Professor Huxley, whose inaugural address we hope to give in our next issue. The meeting is likely to be one of great interest, and various circumstances will combine to bring together an unusual number of the representatives of every branch of science, including not a few of our foreign *confrères*, who we trust will enjoy the peaceful retreat from the turmoil on the Continent. Atomists and Non-atomists, Cataclysmists and Uniformitarians, Darwinians and Anti-Darwinians, will, for the moment, take the place of Gauls and Teutons—would that *their* differences could be as peacefully discussed! Some useless talk there doubtless will be, but we trust much earnest search after truth for truth's sake, and much evidence of real scientific work accomplished during the past year. We shall endeavour to give a report of the proceedings in the various sections, and to this end we must ask, and confidently expect to receive, the hearty co-operation of the Association itself, not only of the officers of sections, but of every individual member who takes part in the meeting.

THE result of the experiments at Woolwich in reference to war balloons is that it has been found that a height of 100 fathoms at horizontal distance of 600 fathoms from the enemy would enable observers to secure the widest expanse of view. It is ascertained that captive balloons attain stability. The balloon having taken a stationary position, eight cameras and lenses spread round the country at equal distances enable the country to be photographed. The inclination and length of the cord to keep the balloon in the same stratum of air was found to be easily calculable. By the new system of military telegraphy for field service telegraph wires can be carried through the air from *terra firma* to a balloon, and the wire can be paid out as fast as the balloon sails; and two or more balloons can be kept in communication with each other, so that telegraphic operations can be made from the balloon to head-quarters and thence to the base of operations. It is believed that war balloons will be manufactured at the Royal Arsenal, and that officers of Royal Engineers will be trained in their use.

THE *New York Technologist* for September describes a pocket rifle invented by Mr. Stevens. It is said to be capable of doing very accurate work, and the price is moderate. The method of loading is so simple that the weapon can be fired five times in a minute. By simply touching a spring the muzzle of the barrel drops down, leaving the breech exposed; a cartridge is then inserted, the barrel returned to its place, and the weapon is ready for use. For all light game they cannot be surpassed, and their penetration is considerable, driving the ball through three one-inch boards.

MR. W. G. SMITH has recently called attention to the great amount of heat generated by fungi, confirming Dutrochet's observation that it is greater in the case of *Boletus æneus* than of any other plant except the Arum. Mr. Smith believes that it is common to all *Boleti*, especially after decomposition has set in. Three large and beautiful specimens of *Boletus colopus* packed in a box were found by Mr. Smith to raise the temperature of the air from 70° to 75° Fahr., the heat evolved being apparent to the hand.

WE gain some notion, says the *Gardener's Chronicle*, of what a siege means when we learn from Paris that the veteran director of the Jardin des Plantes, the well-known chemist, Chevreul—aptly called, from his researches into the nature of fatty substances, "the king of the fatty acids,"—has placed himself at the head of a brigade composed of *employés* of the Museum, and betaken himself to the fortifications. M. Delaunay, the Director of the Observatory, and M. Milne-Edwards, have marched to the scene of action at the head of nearly the whole of the officers and servants of the Academy of Sciences and the Museum. What should we think here in London if the chief librarian of the British Museum, with Professor Owen and Mr. J. J. Bennett as his *aides*, took the field with their subordinates and occupied Shooter's Hill, or if the director at Kew, with his staff, took upon themselves the defence of Richmond Hill? And yet this is what it has come to in Paris.

A SANITARY council for Bohemia has been formed, consisting of Professors Jaksch, Halla, Kaulich, Town-District Surgeon Dr. Grosse of Prague, and District-Surgeon Dr. Hosier of Karolinenthal.

MR. G. FARRER RODWELL has succeeded Dr. Debus as Lecturer on Natural Science at Clifton College.

THE *Yale College Courant* states that Prof. Silliman has resigned his position as instructor of chemistry in that institution.

WE are authorised to state that there is no foundation for the statement which appeared recently in one of the daily papers, that the London Institution in Finsbury Circus is likely to be removed in order to make room for a railway station.

THE preparations for the Argentine National Exhibition at the city of Cordova are in active progress. The building is approaching completion, and the tramway to connect it with the railway station has been commenced. The tramways in the city have experienced great success, and caused an amount of building speculation in the suburbs beyond the available supply of labour. Several important railway proposals, involving prospective loans of magnitude, are under discussion in Congress.

CORNELL UNIVERSITY (for a notice of which see NATURE, August 11) has recently acquired a fine and valuable collection of fossils from one of its many admirers in England. The educational value of such a collection in America, as illustrating the English geological works, is very great, and Cornell University may well be proud that it has so speedily received such a valuable gift.

IT is proposed to found a Museum of History, Antiquities, and Arts, in the Central Park, New York. This movement is under the auspices of the New York Historical Society, and a grant of land has been given by the Government for that purpose. The plan embraces the erection of suitable buildings where historical relics and treasures of local and national interest may be deposited for preservation and exhibition.

SIG. LARANJA E OLIVEIRA forwarded to a recent meeting of the French Academy of Sciences an account of a very remarkable electric shock experienced at Porto-Alegre, Brazil, on the 9th of June. A thunderstorm was progressing at the time, and large drops of rain falling, with a light south breeze. At 100 metres from his own house, as a flash of lightning without thunder appeared over his head, one of Sig. Oliveira's servants felt a remarkable tingling through the whole of his body, ascending upwards from the soles of his feet, succeeded by a violent trembling; his hair stood on end, so as almost to throw off his hat. At the same time, at the distance of about two metres, white smoke ascended from the ground, accompanied by small consecutive flashes of lightning, but the whole lasting only an instant. A door key, which he had in his pocket, attracted for two days afterwards a needle suspended by a thread.

MM. RABUTEAU and Peyre have been experimenting with the root of a plant in use at the Gaboon as an ordeal poison, and locally known as m'boundou or icaja. It will be remembered that it was from this source that the highly valuable Calabar bean was obtained and utilised in medicine. The

authors state that, even in very dilute decoctions, it is very bitter, and appears to contain one or more alkaloids, since the aqueous decoction is largely precipitated by iodide of potassium, and also by phospho-molybdic acid. The poisonous effects of this substance bear some similarity to the effects of brucia; but the authors state that, under certain conditions this poison does not hurt men. Some of the lower animals are readily killed by it; a dose of three milligrammes of the alcoholic extract placed under the skin of a frog kills it; and rabbits and dogs are killed by doses of from 15 to 25 centigrammes of the same extract introduced into the stomach.

M. ROUSILLE, Professor of Chemistry in the Agricultural School of Saulsaie, describes a remarkable phenomenon witnessed by him on Mons Pilatus, at sunrise on July 19th. The air was foggy, the temperature 10·5° C., the barometer 647 mm., the altitude above the sea being 1288 metres. Whitish clouds appeared to form a crest to the mountain, the wind was light from the east, the sun at first very pale, obscured by a light cloud; but suddenly the sky appeared as if on fire, and at the same time the shadow of the mountain was projected on the horizon, at the same time that the image of the sun was reflected in the clouds to the west, surmounted by two rainbows, one above the other, and separated by a grayish band. The image of the sun was orange; the two rainbows which surmounted it consisted of two colours only, red and orange mingled together, and placed symmetrically in each of the rainbows with respect to the separating gray band. The upper bow was paler than the lower one. In proportion as the clouds approached the spectators, the image of the sun increased. At the same time that the rainbows became larger, some black lines became more and more clear, and were soon easily recognised as the shadows of the spectators. As the clouds advanced, the phenomenon disappeared three or four seconds before the spectators were enveloped in them; but the clouds again disappearing, the phenomenon was repeated three times successively in the space of eighteen minutes. The phenomenon appears to have been of the same nature as the well-known Spectre of the Brocken in the Hartz Mountains.

THE second part of Vol. I. of the Natural History Transactions of Northumberland and Durham has just been issued. The following are the most important papers contained in it:—A list of Freshwater Algæ collected in Northumberland and Durham (excluding Diatomaceæ and Desmidiæ) by Mr. G. S. Brady. On a new Labyrinthodont Amphibian from the Northumberland coal field; and on the occurrence in the same locality of *Anthracosaurus Russelli*, by Albany Hancock. The new Labyrinthodont, obtained from the Low Main seam of the Newsham colliery is a small species of Huxley's genus *Urocordylus*, and the name proposed is *U. reticulatus*, expressive of the reticulated structure of the surface of the cranial bones. On some curious fossil fungi from the Black Shale of the Northumberland coal field, by A. Hancock and T. Atthey (illustrated). The same authors contribute two papers (also illustrated) on the genera of fossil fishes *Climaxodus* and *Janassa*. Notes on the Entomostraca of Northumberland and Durham, by Mr. G. S. Brady (illustrated). The Meteorological and Climatological Reports for 1869, by the Rev. R. F. Wheeler, occupy a considerable portion of the volume, and are illustrated by tables and some very curious and interesting drawings of the solid residue left on evaporating rain-water, which fell in London, on the Clyde, at Manchester, and at Newcastle. The volume closes with the annual address to the members of the Tyneside Naturalists' Field Club, by the President, Rev. R. F. Wheeler.

DR. W. F. R. SURINGAR has contributed to the Annals of the Botanical Museum of Leyden a monograph of the Algæ of Japan, chiefly those collected by Von Siebold. The illustrations, both of the Diatomaceæ and the Sea-weeds, are of extreme beauty.

PROFESSOR HALFORD, of the University of Melbourne, in a paper read before the Medical Society of Victoria, has reviewed at length the history of twenty cases of snake-bite treated by his method of injecting liquor ammoniæ into the veins during the last eighteen months. These cases were all in the hands of different practitioners in the colony, who have each reported on them. Recovery followed in seventeen cases. In thirteen of these the practitioners in attendance expressly report that the patients were in a dying condition, and, in their belief, would soon have died, but for the employment of this remedy in the manner prescribed. The method employed was that introduced by Dr. Halford, and first brought to the knowledge of the profession here by him, in the pages of the *British Medical Journal*, through Mr. Paget; viz. by injecting dilute ammonia—say, at the least, thirty minims of the liquor ammoniæ B. P., specific gravity 959—into a superficial vein; the vein being first exposed, and its coats pierced with the nozzle of a hypodermic syringe. Dr. Dempster, Dr. Rae, Dr. Langford, Mr. Dallimore, and Dr. Meyler, each in his own words, and from the observation of separate cases, describe the curative effect as being immediate, and the recovery from collapse to be so rapid and startling as to be "almost magical." This method of treatment, of which such remarkable effects are detailed, has been sharply criticised; but Prof. Halford successfully vindicates the claim of the snakes to be considered highly venomous—almost as much so, he intimates, as some of his London critics. They included the tiger-snake, the brown and black snake of Australia, which are affirmed to be as deadly as the cobra and rattle-snake of India. Strong testimony to the efficacy of the treatment in saving life was borne by Australian practitioners who took part in the discussion, and vindicated Prof. Halford's claim to be considered as the discoverer of a means of rescuing many from an otherwise inevitable death.

A VALUABLE addition to scientific literature has been lately published in Boston, viz.: "Alaska and its Resources," by Mr. W. H. Dall, the director of the Scientific Corps of the late Western Union Telegraph Expedition. This work throws much light upon the flora and fauna of this little visited and comparatively unknown portion of America, lately acquired by the United States Government.

F. MULHAUSEN, civil engineer of Brunswick, has invented, according to the *British Medical Journal*, a new freezing and ventilating machine of remarkable ingenuity. The cold is produced by the mechanical expansion of atmospheric air. It produces, when in operation, any desired degree of cold, freezes water without the use of any chemical agents, and will effectually cool and ventilate any apartment or building, on whatever scale, large or small. In hospitals, especially in tropical climates, where the production of ice and the cooling of the air are often matters of great urgency, and always of great value, in theatres and workshops, and in our new Indian barracks, such a machine will be of infinite value. The London theatres can hardly afford to be without it. The labour of one man, with a small 5-horse motor power machine, will produce 100lb. of ice an hour, and cool 15,000 cubic feet of air from 30° to 50° below Reaumur (*sic* in *B.M.J.*) The production of pure ice, for the purpose of cooling our drinking-water and furnishing a cheap mode of replenishing our domestic refrigerating safes during the hot season, will be a great addition to the sum of comfort in London life. Cheap ice will be especially a great boon to the hospital and sick-room; nothing is so refreshing for the parched lips of the sick man. If it were not so costly as it now is, ice would be very largely used in all hospitals, and would be an infinite boon to the sick.

SCIENTIFIC INSTRUCTION AT THE IOWA STATE UNIVERSITY

THE *American Scientific Monthly* states that the faculty of the State University of Iowa have, with marked unanimity, resolved to recommend to the Board of Regents a new course of study for the first three years, in order to adapt the internal organisation of the institution to the spirit of the new organic law passed by the late General Assembly.

According to this plan, the students have four regular hours of work, lecture, or recitation each school day. This time is equally divided between the *letters* (language, history, &c.), and the *sciences* (mathematics, physical and natural science). The direction of these two classes of studies is to be respectively under the Faculty of Letters and the Faculty of Science, each to have complete control over one-half of the students' time.

Of the two hours spent in the different sciences, one hour is devoted to mathematics, the other, in the two first years to physical, in the third year to natural science. This order might, perhaps, with advantage to the student, be changed so as to have the second year in physical science succeed instead of precede the year in natural science; the student would thereby profit from his greater proficiency in mathematics.

After having completed this three-years' course—which is the same for all students in the sciences, but permits the student, under certain wholesome restrictions, to substitute the different languages one for the other—the student can intelligently decide whether he desires to graduate in the sciences, the letters, or in pedagogics. In the last case, he needs not to have studied any foreign language, but will have spent a great amount of time in the study of his vernacular and its literature; he may then enter the Normal Department, and, at the close of one year, receive the degree of B.D. (Bachelor of Didactics). If, however, he has studied foreign languages, especially Latin and German, he can, after two years of studies, selected according to his own pleasure from among the higher branches taught at the University, obtain either the degree of B.Ph. (Bachelor of Philosophy) or B.A. (Bachelor of Arts). To obtain the former, at least two-thirds of the studies selected by him must have been in the department of Science, while to obtain the latter degree the same fraction should have been studied in the department of Letters.

Facilities for part-graduate courses are also offered, and have, indeed, already been improved by several gentlemen in the past year. We abstain from giving forth details concerning this plan until the Board of Regents shall have taken action thereon. We believe, however, that this plan, in a judicious manner, combines the best features of the American College system with the German University system. It will equally prevent one-sidedness and class-drudgery; while securing familiarity with the *elements* of the principal branches of human culture, it will, at the same time, not only permit each mind to follow its own bend, but also give every individual a fair chance to ascertain correctly in what direction his mind leads him.

This new organisation is especially important to those interested in science. Hitherto, most students commenced the study of science after having spent several years in book studies, especially the dead languages. It seemed they had been imbued with the absurd notion that such studies form a proper preparation for the study of physical and natural science. Experience has, however, abundantly confirmed the common-sense view, that the exclusive pursuit of such literary branches, by permitting the faculties of observation and logical reasoning to slumber, does unfit students for the successful study of nature. For the sake of the student, we are glad that this system, at last, has been thoroughly abandoned. The students will hereafter commence the study of physical science immediately upon entering the University, and, in regular succession, become familiar with the elements and principles of the same. They will take up the natural sciences only after they have become familiar with the elements of physical science. Hereby the professors of physical and natural sciences will, at last, have an opportunity given to teach science in such a manner and at such a time as they deem necessary. We are glad to state that this great reform has the cordial support of each member of the faculty.

NEW CLASSIFICATION OF CLOUDS*

NO one is ignorant that the study of clouds is, from the point of view of our practical needs, one of the most important questions meteorology can present us. Indeed, there is no other meteorological manifestation can so fix the attention of the yeoman in the city, of the agriculturist in the country, of the tourist on the mountain's summit, of the soldier in war, of the sailor in continual strife with the disturbances of atmosphere and sea, and, in fine, of the savant in general.

We everywhere see these different social elements continually watching the diverse appearances which the clouds offer us, and casting upon them a look of interrogation, of disquietude, of desire, of a wish constantly renewed to grasp their forms, in order to predict good or bad weather, according to our social needs.

It is especially when the atmosphere threatens some perturbation, rain, storm, tempest, that the common people examine the character of the clouds. But how often, at every moment of the day, do they ask each other about the temperature, hot, cold, or wet, which sensibly exists, while just as often do they pass by unheedingly the clouds, which exert a no less direct or indirect action upon atmospheric variations, as well in the abnormal state as in the normal.

Moreover each country, according to its geographical position, topography, &c., has its own type of clouds. Here the *Cirrus* predominates, there the *Cumulus*, elsewhere such and such form of clouds which do not exist in other places. All these different appearances of clouds are everywhere intimately connected with some particular condition of climate, and these climatological conditions powerfully influence, in their turn, the health, agriculture, navigation, and the thousand other social concerns of humanity. We may say that the clouds are a great book of nature, constantly open for the perusal of all classes of society. Like a compass, the clouds show us at every instant the direction, the velocity, and the altitude of the superior currents which afterward determine the inferior winds at the surface of the earth. There is, therefore, a permanent weathercock as long as the sky contains a single cloud, however small it may be.

There is necessity, therefore, for undertaking a profound study of clouds in their diverse scientific and social applications; for making researches upon the *nature, form, quantity, direction, velocity*, and *azimuthal rotation* of clouds, corresponding to each stratum perfectly characterised by the origin, intimate constitution, and meteoric products of the vesicular vapours and congealed particles which constitute them. For, in the intimate nature of clouds there is a fundamental condition to be established, which results from the physical force acting immediately after gravitation, upon their constitution. This is the element of *heat*.

Despite this scientific interest, despite this practical need which each feels, and which is so universally acknowledged, despite all this, the study of clouds is yet unhappily in its infancy. It is rarely one sees "clouds" inscribed in the meteorological registers of observatories, and when they are, the registrar has wholly neglected to note their form, their quantity, their direction, their velocity, and their azimuthal rotation. Some say simply, "clouds;" others mention the form or the quantity, may be the direction, or exceptionally these three elements, but assuredly they neglect the velocity, and especially the azimuthal rotation which I have first signalised in clouds, and which is not yet understood. In fine, not a single register gives these five elements for one stratum of cloud, much less for each distinct stratum of those which very often appear superposed in the atmosphere.

* Contributed by Prof. Poey, of Havana, to the Semi-Annual Session of the National Academy of Sciences, held at Washington.

We now proceed to present the basis of a new classification, more in harmony with the actual data of the science, and which is the fruit of twenty years' assiduous study upon the clouds, in the Antilles, as well as in Mexico, the United States, and Europe. From the beginning (at that date) of my meteorological studies at Havana, a city situated in the tropics where the *ensemble* of atmospheric phenomena affects an extreme simplicity in consequence of their surprising regularity, which is effaced as we approach the higher latitudes, ever since, I say, I have more and more felt the necessity of reforming Howard's nomenclature. For a long time I was unable to understand the four cloud formations, which I had come to reject, namely: Stratus, Nimbus, Cumulo-Stratus (different forms of Cumulus), and Strato-Cumulus. It was only later that, having been able to consult Howard's original work, I perceived the errors into which Kaemtz and all the meteorologists had fallen. I have, then, to introduce into Howard's classification the essential modifications which the continued progress of meteorology now requires, in order that the nomenclature may be more in harmony with our new conquests. I acknowledge with pleasure that Howard's classification of clouds, which has ruled without a rival for more than half a century (A.D. 1802), was originally based upon a profound study, directed by great acuteness in the observation of facts. But unhappily this is too plainly stamped with the locality where Howard's studies were alone prosecuted. I am speaking of the gray and cloudy sky of Great Britain, whence are his *Strato-mist*, his imperfect distinction of the two strata *Cirrus* and *Cumulus*, or his *Nimbus* (the rain cloud), the difference which he has established between *Cumulus* and *Cumulo-stratus*, without counting many other details of description, which are faulty, in relation to Cirrus, Cirro-stratus, and Cirro-cumulus.

Here is now the vindication of my three new clouds. When certain clouds are spread out uniformly, cover the whole face of the heavens, take a gray or ash-colour, under which state rain may occur for hours and whole days, what name do we give to these clouds? They are not Howard's *Nimbus*, as we conceive them and as they are generally described. These clouds are neither stormy, nor have they electrical manifestations, there is only a fine and continuous rain. Under this stratum—for it is a true stratum—we see constantly other clouds more or less considerable, but always isolated, come to be lost in it and to increase its thickness. On the contrary, before this stratum begins to break up, and during this operation, we see these same formless fragments detach themselves and fly to other regions. This inferior stratum is not alone, for when its disruption has taken place we see through it another stratum of clouds, whiter and less dense, which is broken up in its turn, and ends by disappearing in an inverse order to that of the first inferior stratum. Have we a name for this variety of cloud, so common in time of rain from the inter-tropical regions to high latitudes, especially in winter, during falls of snow? Does Howard's term Nimbus and his description of it account for this sort of cloud? Certainly not. We name indifferently a *Nimbus*, the single storm cloud, as well as this inferior stratum, or yet the two united strata, and all this without electrical manifestations. This is what I call *Pallium*; that is to say, those strata of which the superior is formed of *Cirrus*, constitute the *Pallio-cirrus* and the inferior of *Cumulus* constitute the *Pallio-cumulus*. The fragments of clouds which differ entirely from the *Cumulus* or *Cumulo-stratus* are the *Fracto-cumulus*.

Hence we see the necessity of distinguishing these two strata by different names; Howard's unique name of Nimbus did not do this, while granting him the greatest descriptive exactitude, which he is far from possessing. This necessity results moreover from the fact that the stratum of *Cirrus* is formed many hours, and even many days, before that of *Cumulus*, especially in the equatorial regions, and in fine that the latter disappears first. Without this distinction we are obliged to call the first stratum *Cirrus* and the second *Cumulus*; but as under this state of strata the form and physical properties of Cirrus and Cumulus change completely, there results the confusion and errors daily committed.

As regards Howard's classification as a whole, while retaining the two types of *Cirrus* and *Cumulus*, with his two derivative clouds, *Cirro-stratus* and *Cirro-cumulus*, I reject entirely his *Stratus*, his *Nimbus*, and his *Cumulo-stratus*, together with the *Strato-cumulus* of Kaemtz, for the following reasons: *Stratus*, because it is not (according to Howard) a cloud properly so-called, but a *mist* or *hoar frost*, or yet by the effect of an optical illusion, a *Cirrus*, a *Cirro-stratus*, or a *Cirro-cumulus*, as seen in perspective at the horizon; *Nimbus*, for the reason that it is an inexact denomination which is moreover applied to an idea as vague as incorrect, from the moment that *Cumulus* is not truly rainy as far as it is found displayed, forming a stratum as dense in appearance and below a second superior stratum of *Cirrus*, equally rainy; *Cumulo-stratus*, because it differs in nothing from Cumulus, according to Howard's own definitions, the three fundamental characters of cloud type and of its derivations being common to these two forms, namely: their horizontal bases, their superior hemispherical basins, and the ascending aggregation of their aqueous particles; in fine, *Strato-cumulus* (Kaemtz's cloud of night), because this modification answers in no manner, no more than Howard's *Stratus* to *clouds of night*, and because, on the contrary, its other characteristics correspond to *Cumulo-stratus*.

On the other hand, I substitute for *Nimbus* the *Pallium*, which I sub-divide into *Pallio-cirrus* and *Pallio-cumulus*, according as its stratum is composed of *Cirrus* or *Cumulus*. This term has the triple advantage of embracing the character, the form, and the effect—that is to say, the *Cirrus* or *Cumulus* forming a rainy stratum. I introduce, in fine, the determination of a second transitorial form, which seems to me can be rigorously distinguished from the preceding in the double relation of cause and effect. This is the *Fracto-cumulus* fragments of clouds which are wandering about without determined form, before their transformation into *Cumulus* (or *Cumulo-stratus*), which are precipitated or detached from the inferior surface of the stratum of *Sallio-cumulus*, and which, in fine, are spread out in horizontal bands at the summit of the *Cumulus* on the approach of gusts of wind. These *Fracto-cumulus* differ from the Cumulus in this: they have neither the horizontal base nor the superior hemispherical basins while they are not very extended; but as soon as they become a little more increased we see at once forming at the centre of the fragment a space more dense and blackish than the rest, which gradually settles until it constitutes the horizontal base of the *Cumulus* (*Cumulo-stratus*), the upper part also becoming rounded by degrees. Thus the *Fracto-cumulus* is the infancy of the *Cumulus*, otherwise called *Cumulo-stratus*, the terms being synonymous.

This new classification is wholly based upon the *nature*, the *form*, the *quantity*, the *direction*, the *velocity*, and the *azimuthal rotation* of the clouds corresponding to each stratum fully characterised by the origin, intimate constitution and meteoric products of the vesicular vapours and congealed particles which constitute them. For, in the intimate nature of clouds there is one fundamental condition to be established depending upon the physical force which first acts upon their constitution; it is the element of *heat*. Clouds are therefore distinguished into *snow clouds* and *ice clouds*, of which the constituent particles are more or less congealed; then into *clouds of aqueous vapour*, of which the vesicles, empty or full, float in a medium above the freezing point.

Under this fundamental aspect there are but two types of clouds properly so called, the *Cirrus* and the *Cumulus*. To the *Cirrus* are attached three transitional forms: the *Cirro-stratus*, *Cirro-cumulus* and *Pallio-cirrus*; and to the *Cumulus*, two other transitional forms; the *Pallio-cumulus* and the *Fracto-cumulus*.

Here is a table of my new classification of clouds compared with that of Howard:

NEW NOMENCLATURE OF POEY

First type.	*Cirrus*	Ice clouds.
Derivative	Cirro-stratus	Ice clouds.
	Cirro-Cumulus...	Snow clouds.
	Pallio-cirrus......	Snow clouds.
Second type.	*Cumulus*...........	Vesicular clouds of aqueous vapour.
Derivatives	Pallio-cumulus....	
	Fracto-cumulus...	

OLD NOMENCLATURE OF HOWARD.

First type.	*Cirrus*	
Derivatives	Cirro-stratus.	
	Cirro-cumulus.	
Second type	*Cumulus.*	
Derivatives—Cumulo-stratus.		
Third type		*Stratus,*
Derived from the three types—*Nimbus.*		

My nomenclature appears probably more in accordance with the nature of the clouds in this sense than the two types, *Cirrus* and *Cumulus*, are rigorously based upon the constitution of ice

and snow-clouds of aqueous vapour. Where there is no proof of the existence of Howard's third type, being that, according to this savant, it is a mist which overspreads the earth at sunset, but which is raised in the morning at the first appearance of that luminary. As to number, my nomenclature offers the same determination of cloud forms, that is to say, seven—the two types and five derivatives.

The order in which the clouds are placed in my table correspond, at the same time, to the order of their appearance, from the highest region of the *Cirrus* down to those nearest the earth, where the *Fracto-cumulus* are produced, according as the vapour of water passes from the state of frozen particles to that of aqueous vesicles, or *vice versa*. However, the *Pallio-cumulus*, which serves as a transition between the two types and their derivatives, is found a little more elevated than the *Cumulus*.

I have thought it suitable to modify Forster's vulgar nomenclature by substituting other names more in harmony with the form and nature of the clouds. I give in continuation the old and new classification :

	Forster's Nomenclature	Poey's Nomenclature
Cirrus	Curl-cloud	Curl-cloud
Cirro-stratus	Wane-Cloud	Thread-cloud
Cirro-cumulus	Sonder-cloud	Curdled-cloud
Pallio-cirrus		Sheet-cloud
Cumulus	Stacken-cloud	Mount-cloud
Pallio-cumulus		Rain-cloud
Fracto-cumulus		Wind-cloud

With the exception of Cirrus, whose name, "Curl-cloud," approaches nearest the form of this species of cloud, all the determinations have been changed. The Pallio-cumulus replaces the Nimbus, also named "Rain-cloud."

I.—CIRRUS (HOWARD).

Cirrus, so named by Howard ("the cat's tail," of sailors), are composed of filaments, whose *ensemble* resembles sometimes a curled hair, a twisted tuft, plumage, the flowing tail of a horse, at other times they are disposed in long, straight bands parallel to each other, or divergent palmated, or like a fish bone or vertebral column, their greater axis being oriented according to the sailing of the cloud and the direction of the wind existing at that altitude, which is not slow in making itself felt on the earth. When they form two or more systems of straight parallel bands, by an effect of perspective, they appear to diverge from their point of departure at the horizon and to converge toward the point of the horizon diametrically opposite, as do the rays of the rising or setting sun.

The *Cirrus* have always a whiteness, sometimes brilliant, sometimes pearly dull. The earliest and the latest reflections of the solar rays upon the clouds colour them with a charming rose tint, more or less intense, according to their density. Their propagation is excessively slow, and their altitude is not less than 10,000 metres (more than six and a quarter miles). These clouds are the highest, slowest, most rarified, most variable in their forms, and the most extended. The appearance and disappearance of *Cirrus* proclaim simultaneously the end and the commencement of good weather. The barometer sinks and then rises, the *ensemble* of meteorological accompanying phenomena pursuing the same course. We quote from Howard :

"They are first indicated by a few threads pencilled, as it were, on the sky. These increase in length, and new ones are in the meantime added to them. Often the first formed threads serve as stems to support numerous branches, which in their turn give rise to others.

"The increase is sometimes perfectly indeterminate ; at others it has a very decided direction. Thus the first few threads being once formed, the remainder shall be propagated in one or more directions laterally, or obliquely upward or downward, the direction being often the same in a great number of clouds, visible at the same time ; for the oblique descending tufts appear to converge toward a point in the horizon, and the long straight streaks to meet in opposite points therein, which is the optical effect of parallel extension. The upward direction of the fibres or tufts of this cloud is found to be a decided indication of the decomposition of vapour preceding *rain* ; the downward as decidedly indicates *evaporation* and fair weather. In each case they point toward the place of the electricity which is evolved at the time.

"Their duration is uncertain, varying from a few minutes after the first appearance to an extent of many hours and even days. It is long when they appear alone and at great heights, and shorter when they are formed lower and in the vicinity of other clouds.

"This modification, although in appearance almost motionless, is intimately connected with the variable motions of the atmosphere. Considering that clouds of this kind have long been deemed a prognostic of wind, it is extraordinary that the nature of this connection should not have been more studied, as the knowledge of it might have been productive of useful results.

"In fair weather, with light, variable breezes, the sky is seldom quite clear of small groups of the oblique *Cirrus*, which frequently come on from the leeward, and the direction of their increase is to windward. Continued wet weather is attended with horizontal sheets of this cloud, which subside quickly and pass into the *Cirro-stratus*.

"Before *storms* they appear lower and darker, and usually in the quarter opposite to that from which the storm arises. Steady high winds are also preceded and attended by streaks running across the sky in the direction they blow in."

II.—CIRRO-STRATUS.

Thread-cloud.—Howard's *Cirro-stratus* is distinguished from the pure *Cirrus* by its filaments being smaller, more compact, more ramified, and, so to say, completely stratified. They are lower, more dense, for often the sun's rays pierce them with difficulty. Their whitish tint is clearer, and it also becomes rose colour in similar circumstances. Their motion is a little more rapid. When at the horizon, we only seeing the vertical projection, they take the appearance of a long and very narrow band. Howard says :

"This cloud appears to result from subsidence of the fibres of the *Cirrus* to a horizontal position, at the same time that they approach each other laterally. The form and relative position, when seen in the distance, frequently give the idea of shoals of fish. Yet in this, as in other instances, the *structure* must be attended to rather than the *form*, which varies much, presenting at times the appearance of parallel bars, or interwoven streaks like the grain of polished wood. It is thick in the middle, and extenuated towards the edge. The distinct appearance of a *Cirrus*, however, does not always precede the production of this and the last modification.

"The *Cirro-stratus* precedes *wind* and *rain*, the near or distant approach of which may sometimes be estimated from its greater or less abundance and permanence. It is almost always to be seen in the intervals of storms. Sometimes this and the *Cirro-cumulus* appear together in the sky, and even alternate with each other in the same cloud, when the different evolutions which ensue are a curious spectacle ; and a judgment may be formed of the weather likely to ensue by observing which modification prevails at last. The *Cirro-stratus* is the modification which most frequently exhibits the phenomena of the Solar and Lunar halo, and (as supposed from a few observations, the Parhelion and Paraselene also. Hence, the reason of the prognostic of foul weather—commonly drawn from the appearance of Halo. The frequent appearance of Halo in this cloud may be attributed to its possessing great extent, at such times, with little perpendicular depth, and the requisite continuity of substance.

"This modification is, on this account, more peculiarly worthy of investigation."

III.—CIRRO-CUMULUS.

Curdled Cloud.—It is sufficient that the *Cirro-stratus* sink a little, or that the temperature of the region they occupy be slightly elevated, in order that the frozen aiglets may be reduced to snow, and give birth in consequence to Howard's *Cirro-cumulus*. In the first place the axes of the *striæ* grow round ; then, by degrees, the entire stratification becomes so, until it forms little balls or corded cotton which we call "frizzled" clouds of "curled" sky (in French, *moutonnes* or *pommele*,) when it is completely covered ; in Spanish, *cielo empedrado*. On the contrary, if the *Cirro-cumulus* are elevated a little, or if the temperature is lowered, they return to the superior type of *Cirro-stratus*. The little balls of snow are congealed and crystallised anew into aiglets.

The *Cirro-cumulus* are more dense and lower than the *Cirro-stratus*, from which they are derived, although generally the edges of the small agglomerations or of the entire mass of cloud is transformed into *Cirro-stratus*, whenever, by a greater elevation or a lower temperature, the congelation is more vigorous. Their motion is also more rapid, their colour slightly greyish, and they may, moreover, be tinged rose-colour, or, rather, become reddish.

The *Cirro-stratus*, but more especially the *Cirro-cumulus*, are remarkable by reason of a characteristic of the highest importance, from the point of view of the distribution of congealed aqueous vapour, and one which has escaped the sagacity of Howard and his successors. It consists in the most fantastical combinations, reproducing all the formations, hydrological, and physical, of our Continent and seas. Here a deep bay with promontories, capes, peninsulas, isthmuses, &c.; there, a river, brooks, lakes, &c.! further on, vast continents and open seas. The entire mass and the outlines of each of these accidents are besprinkled with *Cirro-cumulus*, sometimes edged with *Cirro-stratus*, of which the volumes of little balls are seen diminishing and vanishing from centre to circumference, while at the side, in the empty spaces, we perceive the purest azure of the heavens. Should it be a lake, the water will be represented by the blue sky, and *terra firma* by the *Cirro-cumulus* which surrounds it. By carefully studying all these transformations we remark in them the greatest analogy with the phenomena of the precipitation and congelation of dew upon solid bodies. There is, therefore, at this altitude, in the same stratum, and one after the other, so to say, some portions of the atmosphere enjoying different degrees of density and of temperature, in order that the congelation of aqueous vapour may take place in so variable a manner.

The influence of *Cirro-cumulus* upon the lowering of the temperature at the surface of the earth is so considerable that the human body feels it at once. A curdled sky at the new moon of a calm night in the tropics is a sky relatively glacial for these latitudes.

This effect may be due to their greater proximity and to the considerable quantity of balls of snow which constitute this type of cloud. The *Cirrus* being found much elevated and the *Cirro-stratus* much less abundant, although both are formed of glacial aiglets, have not the same influence upon the terrestrial temperature. Howard says:

"The *Cirro-cumulus* is formed from a *Cirrus*, or from a number of small separate *Cirrus*, by the fibres collapsing, as it were, and passing into small, roundish masses, in which the texture of the *Cirrus* is no longer discernible; although they still retain somewhat of their relative arrangement. This change takes place throughout the whole mass at once, or progressively from one extremity to the other. In either case the same effect is produced on a number of adjacent *Cirrus* at the same time and in the same order. It appears in some instances to be accelerated by the approach of other clouds.

"This modification forms a very beautiful sky, sometimes exhibiting numerous distinct beds of these small connected clouds, floating at different altitudes.

"The *Cirro-cumulus* is frequently seen in summer, and is attendant on warm and dry weather. It is also occasionally and more sparingly seen in the intervals of showers and in winter. It may either evaporate or pass to the *Cirrus* or *Cirro-stratus*."

Under the generic name of *Pallium*, I have classed two forms of clouds, which present the appearance of a mantle or veil of considerable extent, of very compact texture, well defined at the edges, of an excessively slow march, and embracing, moreover, the visible vault of the sky. According as the *Pallium* is formed of *Cirrus* or of *Cumulus* it is distinguished into *Pallio-cirrus* and *Pallio-cumulus*. The appearance of these clouds signalises bad weather, and their disappearance good weather.

The stratum of *Pallio-cirrus* is first formed, and some hours or some days afterwards that of *Pallio-cumulus* is formed under it. These two strata remain in view at a certain distance from each other, and by their reciprocal action and reaction produce storms and the heavier rains, accompanied with considerable electric discharges. They are electrified, but with contrary signs; the superior stratum of *Cirrus* is negative, and the inferior one of *Cumulus* is positive, the same as the rain which it disengages; while the electricity of the air, at the surface of the earth, is negative. But when these two strata attract each other a discharge is produced; and the inferior stratum continues to pour out the surplus water it contained without giving any sign of electricity, no more than the air in contact with the earth. This state continues until the inferior stratum opens up, the superior afterward, they then disappear, the one after the other. Fine weather then returns. The *Pallium* chiefly predominate during the rainy season, in inter-tropical regions, and in the higher latitudes during winter, at the time of falls of snow. A part of the *Pallio-cumulus*, which has not been reduced, or which has not been scattered to other regions, gathers at the horizon and is transferred into the *Cumulus*. As to the *Pallio-cirrus*, they disappear entirely if fine weather is maintained.

THE ANCIENT LAKES OF WESTERN AMERICA, THEIR DEPOSITS AND DRAINAGE *

THE wonderful collections of fossil plants and animals, brought by Dr. Hayden from the country bordering the Upper Missouri, are from deposits made in extensive fresh-water lakes which at one time occupied much of the region lying immediately east of the Rocky Mountains. The water of these lakes was first salt or brackish, as the remains of oysters and similar estuary forms show. By continental elevation the whole country west of the Mississippi was raised out of the cretaceous sea, and these estuaries became lakes inclosed by raised dry land. The knowledge of this country from the Mississippi to the Pacific Ocean has been accumulated by various explorers besides the writer, as Dr. Hayden, Mr. George Gibbs, Professors W. P. Blake and Thomas Antisell, and Prof. J. D. Whitney and the State Geological Survey of California, and Baron Richtofen, the lamented Rémond, Drs. Shiel, Wislizenus, and others. Besides Mr. Clarence King has explored a large tract of this country, but his very important contributions have not, as yet, been made public. The general character of the topography of the region west of the Mississippi has been given by these great lines of elevation traversing the country from north to south. There are the Rocky Mountains, the Sierra Nevada, and the Coast Ranges. The last is the most modern, and is composed, for the most part, of Miocene Tertiary rocks. Parallel with this lies a narrow trough, in California traversed by the Sacramento and San Joachin Rivers, encroached on by the mountains at places, but still in Oregon and Washington, traversed by the Willamette and Cowletz Rivers. These two sections are drained through the Golden Gate and Columbia. The mountain barriers formerly caused the valleys to consist of great inland lakes, which are now only represented by the chain of small pieces of water still to be seen in that region of country. East of the Sierra Nevada and between it and the Rocky Mountains is another still larger basin. For a thousand miles it has no openings to the westward, which are less than five thousand feet above the sea, but at three points there are gateways, which may be passed, but little above the sea level. These are the *canons* of the Sacramento (Pit River), the Klamath, and the Columbia. These have been cut through by the drainage of the interior of the continent. The former beds of the lakes have thus been left dry and waste—the only real desert on the North American continent. The Sierra Nevada is older than the Coast Ranges, and projected above the ocean, though not to its present altitude, previous to the Tertiary and even Cretaceous ages. This we learn from the fact that strata belonging to these formations cover its base. The mass of the Sierra Nevada is granitic rocks and metamorphic slates, proved by the California Survey to be triassic and jurassic. These slates are traversed by the gold-bearing quartz. East of the Sierra Nevada is a high and broad plateau five hundred miles wide, and from four to eight hundred feet in altitude, and reaches south into Mexico. This mountain belt was once the margin of the Pacific Ocean. Its crest is crowned by volcanic cones like gigantic towers of a fortification. The central portion of this plateau was called by Fremont "the great basin," as it forms a hydrographic basin drained by the Columbia and Colorado. The former makes its way to the ocean through a gorge in the Cascade Mountains, whilst the latter escapes to the south through a series of *canons*, of which the most important is nearly a thousand miles in length, and from three to six thousand feet deep. In vol. vi. of the Pacific Railroad Reports the country of the Columbia is described and the reasons for concluding that it had cut its way through the Cascade Mountains, and similar facts were observed in the district drained by the Klamath and Pit Rivers. Certain peculiarities are to be seen in the country between the Sierra Nevada and Rocky Mountains. In the northern and middle portions of the great table lands the surface is somewhat thickly set by short and isolated mountain ranges, sometimes called "the lost mountains." These rise like islands above the level of the plain, and are generally com-

* Contributed by Professor J. S. Newberry to the Proceedings of the New York Lyceum of Natural History.

posed of volcanic or metamorphic rocks. The spaces between them are level desert surfaces. Towards the north and west, on the tributaries of the Columbia, Klamath, or Pit Rivers, the plateau is cut by these streams, and the deposit can be examined. The rocks are nearly horizontal, some are coarse volcanic ash, with fragments of pumice and scoriæ. Others denominated "concrete" resemble the old Roman cement. Many are quite white, and are generally known as "chalk-beds," though they contain no lime. The late Prof. J. W. Bailey determined these to consist of the remains of fresh-water species of Diatomaceæ. The stratification and horizontality of these beds show them to have been thrown down from great bodies of water which once covered the greater part of these level plains. From south-western Idaho and eastern Oregon have lately been brought large collections of animal and vegetable fossils, of great variety and interest. The plants were mostly collected by the Rev. Thomas Congdon, of the Dalles, Oregon, at great risk of life and while exposed to great hardships, on the flanks of the Blue Mountains. They are apparently Miocene, forming twenty or thirty species, nearly all new, and which represent a forest growth as varied and luxurious as can be found on any portion of the continent. The animal remains came mostly from the banks of Castle Creek in the Owyhee district, Idaho. These were sent by Mr. J. W. Adams of Ruby City. They consist of bones of the mastodon, rhinoceros, horse, elk, and other large mammals of which the species are probably in some cases new, in others identical with those obtained from the deposits examined by Dr. Hayden. There are also bones of birds and great numbers of the bones and teeth of fish. These last are cyprinoids applied to *Mylopharodon*, *Milocheilus*, &c., some three feet and more in length. Also many fresh-water shells, as *Unio*, *Corbicula*, *Melania*, and *Planorbis*. These illustrate the inhabitants of the extinct lakes, which were of a much larger size and greater depth than the great fresh-water lakes which now lie upon our northern frontier. Between these were areas covered with a luxuriant and beautiful vegetation and inhabited by herds of elephants and other great mammals. In the streams were numbers of fish and mollusks of species now extinct. Gradually these lakes evaporated and at last became dry. In the Klamath lakes and Suisun Bay we have their remanents, whilst on the Columbia the drainage streams have cut *canons* two thousand feet deep. At times the peace and quiet of this country were disturbed by violent volcanic eruptions from the peaks of the Sierra Nevada, which ejected showers of ashes covering the land and filling the lakes, as is seen in the strata now existing, some ten and twenty feet thick. Sometimes lava was thrown out and covered hundreds of miles of surface, and is now seen as solid basalt. Then quiet reigned, and new fresh-water deposits were formed, only to be succeeded by other volcanic disturbances. Some parts of this plateau have not been drained, and the remains of the ancient lakes now exist as Salt Lake, Pyramid Lake, and others. These are gradually diminishing, as is to be seen by indications all around their borders, where we can trace ancient shore lines. The alkali plains and salt flats mark the places of dried-up lakes; all of these still existing being excessively salt. This is the state of things at the north. In the south, the great Colorado plateau is without mountain barriers or local basins, and there are few traces of extinct lakes. This arid district was once a beautiful and fertile plain, drained by the Colorado, which, on the western margin poured over a precipice five thousand feet or more high, into the Gulf of California, which then reached several thousand miles farther north than it does now. In time the river cut its way farther back through the subjacent rocks, and at last formed that remarkable gorge, nearly a thousand miles long and three to six thousand feet deep. As the channel deepened, the country around became dryer, until it was the arid plain we find it now. Almost no rain falls on this plain, therefore the walls of the *canon* remain sharp-cut precipices unaffected by moisture. On the east of the Rocky Mountains is the great plateau country of the plains, which differs from the country to the west, by not being bordered on its east by a mountain chain, but sloping gradually to the Mississippi. Its surface was also covered by great fresh water lakes, larger, if not more numerous, than those now existing on our northern boundary. From the northern portion of this plateau Dr. Hayden has brought his specimens, and he has there obtained a harvest of scientific truth which will form for him an enduring and enviable monument. He has studied the deposits which accumulated in these lakes, and they are very rich in specimens of both animal and vegetable life. The vertebrate remains have been studied by Dr. Leidy, who has published his investigations in the splendid monograph so well known, and which forms a contribution to palæontology, not second in value or interest to that made by Cuvier, by his illustrations of the fossils from the Paris basin, nor to that of Falconer and Courtly, descriptive of the Sewalik hills of India. The first instalment of the plants have been described by Dr. Newberry, in the report of Colonel W. F. Reynolds, U.S.A., not yet published. The descriptions are published in the Annals of the Lyceum of Natural History of New York, vol. 9, 1868. The general conclusions from these examinations have greatly enlarged the flora of the Tertiary and Cretaceous periods. Since then largely additional material has been collected by Dr. Hayden, Mr. Congdon and Dr. Le Comte, and Dr. Newberry; and in Alaska by Mr. W. H. Dall and Captain Howard, and by others in Greenland. The flora and fauna of the lake deposits on both sides of the Rocky Mountains apparently belong to one and the same geological age, and tell the same story as to topography, climatic conditions, and development of animal and vegetable life. There is a striking difference in one particular between the deposits east and west. In Oregon, Idaho, and Nevada, volcanic material has accumulated in the lake basins to a much greater extent than on the east of the mountains. The deposits of the Upper Missouri regions are shales, marls, and earthy limestones, with immense quantities of lignite and almost no traces of volcanic material. The animals and vegetables of the Tertiary here were in much greater number than now. This existed long enough for thousands of feet to accumulate in the lake basins, and sometimes these deposits are found turned up on edge on the flanks of the mountains, showing that this chain, although existing in embryo from the earliest palæozoic ages, has been subjected to great modifications. The collections made by Dr. Hayden at various points differ among themselves. In every bed are new species, and between some deposits there are no connecting links. In the beginning of the cretaceous the land surface and climate of this continent were similar to the present period, the trees for the most part belonged to the same genera. Then most of the region west of the Mississippi sunk beneath the ocean, and the cretaceous deposits were made containing more tropical species. There were islands in the western sea, and the Gulf Stream had a course north and west from the Gulf of Mexico to the Arctic Sea. In the earlier Tertiary ages the continent here emerged from the ocean and approached the previous and present conditions indicated by the flora. In this category are to be placed the Green River Tertiary beds, those of Mississippi studied by Lesquereux, and those of Brandon, Vermont. In the Miocene the continental surface was broader, the western lakes were fresh, and the vegetation very much like that of the present day. A few palms then grew as far north as the Yellow Stone River, and a flora flourished in Alaska and Greenland as varied and as luxuriant as now grows along the fortieth parallel. At this time land connected Europe, this continent, and China, as the flora in this region was essentially the same, a large number of plants being common to the three continents. The mammals were peculiar; over our western plains rolled herds of great quadrupeds rivalling in number and variety those of southern Africa at the present time. This state of things continued during the Pliocene age and up to the ice period. In the middle Tertiary the climates of Alaska and Greenland were those of New York and St. Louis at present. Then came the Glacial epoch, and the climate of Greenland of the present time is brought down to New York, and all the northern portion of the continent is wrapped in ice. This change of climate was gradual, but the animals and vegetables were driven southward until the glaciers reached the thirty-eighth or fortieth parallel, when a temperate climate prevailed in Mexico, and only on the southern border would the temperature be what it had previously been on our northern border. Thus nearly all the animals were exterminated or forced into very narrow limits in southern Mexico. Plants bore their expatriation better, and as a consequence we find the present flora of our continent much more like that of the Miocene than is our fauna, though most of the forest-trees have become extinct. Of these the Glyptostrobus is an example, which grew all over our continent and northern Europe. In the glacial period it was exterminated except in China, where it now grows. So when we compare the present flora of China and Japan with that of the eastern half of our continent, we find the strongest proofs of their relationship; many species are identical, while others are but slightly changed. Some of the great mammals of the pre-glacial period bade defiance to these changes, as the mastodon and elephant, both of which could endure great changes of climate, and the mammoth, we

know, was defended from cold by a thick coat of hair and wool. We find its remains embedded in peat-bogs and marshes, where they were mired and suffocated, and it is even claimed that here, as in Europe, it was contemporaneous with man.

SCIENTIFIC SERIALS

Annales de Chimie et de Physique, July, 1870.—This number contains a paper, by M. A. Müntz, on the Composition of Skin, the modifications it undergoes during the process of tanning, and on the decomposition of tannin in the tan-pits. The experiments detailed in this paper were undertaken by the author to determine, from a theoretical point of view, the changes taking place in the conversion of hides into leather. A piece of ox-hide which was being converted into leather for the soles of boots was selected as the most appropriate for the investigation, and the operations were commenced after cleansing and depilation. In these processes no chemical change would take place, except perhaps in cases in which lime is employed in the depilation, a small quantity of which is deposited in the skin, but afterwards removed by a solution of glucose. The following process of *swelling* consists in steeping the hides in an acid liquid for a time varying from three weeks to two or three months. This acid liquid contains acetic and lactic acids and a small quantity of tannin: its effect is to distend the pores of the epidermis and thus facilitate the subsequent process of tanning. During the swelling so much water and other substances are absorbed that the hide increases in weight to such an extent that it is now as heavy as it was before the cleaning and depilation, the addition of dry matter amounting to nearly 19 per cent.; a small quantity of mineral matter is lost, the augmentation being due to the addition of carbon, hydrogen, and oxygen. After eleven months in the tan-pit an increase of nearly 83 per cent. was observed; a small diminution in the quantity of nitrogen took place, while the mineral constituents and carbon, hydrogen, and oxygen were augmented. The organic materials added had exactly the same composition as those absorbed by the hide during swelling, but they differ much from the composition of tannin. The author believes that the loss of nitrogen during the tanning process is due to a decomposition of part of the leather, for ammonium salts were found in the liquor from the tan-pits. The structure of leather is also very different from that of skin; while the latter is fibrous the former is spongy; skin will absorb three or four times its weight of water, swelling considerably, but leather scarcely absorbs one and a half times its weight, and without increase of volume; 100 parts of skin by treatment with boiling water leave 3·35 of insoluble matter, the rest being converted into gelatine; the residue from leather under the same circumstances is about 48 per cent. The compound obtained by the action of tannic acid on gelatine differs very much in composition and properties from leather. A description is given of a process for the estimation of tannic acid; and M. Müntz announces the observation that the residue, after boiling skins with water, contains a substance dissolved by Schweitzer's cupro-ammoniacal reagent, and thus resembling cellulose, but containing about 15 per cent. of nitrogen. The author next gives an account of the composition of the mineral substances present in skin and in leather, and points out the changes produced during the tanning. He concludes that the tannic acid is partially converted into more oxidised compounds, as gallic acid, glucose, lactic, acetic, formic, carbonic acids, and most probably propionic acid, the remaining less oxidised residue converting the skins into leather. The experiments detailed in this paper were carried out in the laboratory of M. Bossingauult. —M. L. Henry contributes a paper on glyceric tribromhydrine, the object of which is to show that the compound obtained by Berthelot by the action of phosphoric bromide on dibromhydrine or epibromhydrine, and described by him as tribromhydrine, must have been some other compound. The author points out that the saturated compounds of the triatomic radical $(C_3H_5)'''$ obtained either from the allylic group or from glycerine, are always identical, with the single exception of Berthelot's tribromhydrine, which boils at 180°, while the tribromide of allyl obtained by Wurtz by the action of bromine on allylic iodide, boils at 217—218°. He also shows that the analysis given by Berthelot is not as concordant with the theoretical numbers as might be expected, and that the physical properties described by him do not correspond with those that might be looked for in a compound of the composition $C_3 H_5 Br_3$. Finally, he announces that by the action of phosphoric bromide on pure dibromhydrine, he has obtained the true tribromhydrine, which, in all its physical and chemical properties, is identical with the tribromide of allyl of Wurtz.—The next paper is by M. P. Schützenberger, on a new acid of sulphur. Schönbein observed that when a solution of sulphurous acid is placed in contact with zinc the liquid becomes yellow, and acquires the property of decolorising indigo and litmus, but after a short time sulphur is deposited and the reducing action of the liquid disappears. M. Schützenberger has employed a concentrated solution of sodic bisulphite in the place of the sulphurous acid, and has succeeded in preparing the salt of a new acid. A flask of about half a litre capacity was filled with zinc shavings and a strong solution of sodic bisulphite poured in. The vessel was then closed and placed in cold water; after half an hour the odour of sulphurous acid had disappeared, when the liquid was poured into a flask containing 1½ litres of alcohol and the mixture agitated. A crystalline deposit of the double sulphite of sodium and sodium was produced, and from this the clear liquid was rapidly decanted into bottles, which were filled entirely, closed, and allowed to cool. After a short time a mass of fine colourless needles was deposited, consisting of *sodic hydrosulphite* $\left.\begin{matrix}(SO\,H)'\\ Na\end{matrix}\right\}O + H_2O$. It is rapidly oxidised by exposure to the air into sodic bisulphite, and the solution when placed on filter paper is so rapidly oxidised that sufficient heat is evolved to cause steam to be given off. On adding sulphuric or oxalic acid to the solution an orange red colour is produced, but the liquid is rapidly decolorised with deposition of sulphur. Sodic hydrosulphite may also be obtained by nascent hydrogen evolved by electrolysis. The production of this compound is represented as follows:—

$$\underset{\substack{\text{Sodic}\\ \text{bisulphite}}}{\left.\begin{matrix}(SO)''\\ Na\,H\end{matrix}\right\}O_2} + H_2 = \underset{\substack{\text{Sodic}\\ \text{hydrosulphite}}}{\left.\begin{matrix}(SO\,H)'\\ Na\end{matrix}\right\}O} + H_2O.$$

The oxidation of the hydrosulphite thus:—

$$\left.\begin{matrix}(SO\,H)'\\ Na\end{matrix}\right\}O + O = \left.\begin{matrix}(SO)''\\ Na\,H\end{matrix}\right\}O_2.$$

The decomposition of the acid:—

$$2\left.\begin{matrix}(SO\,H)'\\ H\end{matrix}\right\}O = 2\,H_2O + S + SO_2.$$

The solution of the sodium salt is gradually transformed, out of contact with air, into sodic hyposulphite and water:—

$$\underset{\substack{\text{Sodic}\\ \text{hydrosulphite}}}{2\left.\begin{matrix}(SO\,H)'\\ Na\end{matrix}\right\}O} = H_2O + \underset{\substack{\text{Sodic}\\ \text{hyposulphite}}}{S_2O_3Na_2}.$$

By means of an alkaline solution of sodic hydrosulphite indigo is rapidly converted into white indigo; acetone produces isopropylic alcohol; and oil of bitter almonds is partially transformed into benzylic alcohol. This substance promises to be a useful reducing agent for many operations.

IN the *Revue des Cours Scientifiques* for Aug. 27 is a translation of Prof. Hofmann's address in honour of the late Prof. Graham, delivered before the German Chemical Society, which occupies the greater part of the paper. Then follows a report of the sittings of the Anthropological Society of Paris on April 21 and May 5, containing a report on the Ethnology of Lower Brittany, which led to an animated discussion on the origin of species and the theories of transformation and natural selection. A translation is also given of Prof. Sterry Hunt's paper, read before our Royal Society, on the probable seat of volcanic action. In the number for September 3 is a report from M. Giraud-Teulon on the causes of myopy, its relative frequency, and its influence in military efficiency. M. Marey continues his interesting and valuable paper on the flight of birds, which is here discussed from a mechanical point of view. We have the reports of the sittings of the Anthropological Society on May 19, June 2 and 16, and July 7 and 21; the subjects of discussion being the brain of man and of the primates, pathological osteology of the newly-born, acclimatisation of Europeans in Africa, and the conclusion of the discussion on transformation. The *variétés* comprises a paper by Prof. Nélaton, of the Faculty of Medicine of Paris, on wounds produced by fire-arms.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, Aug. 29.—A single paper only was read at this meeting by M. J. Boussinesq, a theoretical essay on the laws, found by experiment by M. Bazin, for the uniform flow of water in open channels. The formulæ deduced by the writer from theoretical considerations he found to agree with those indicated by M. Bazin from experiment, and also not to differ materially from those which M. Darcy has given to represent the rapidity in circular pipes full of liquid, for the axis of the pipe or at one-third or two-thirds of the radius.

NEW YORK

Lyceum of Natural History, May 9.—The President in the chair. Professor Charles A. Seely "On the Constitution of Ammonium-amalgam."—Dr. Isidor Walz's "Notes on the Extinction and Reducing Power of Mercury." "At the last meeting of the Chemical Section of the Lyceum, I drew attention to the conversion of liquid zinc-amalgam to a gray powder, when shaken with a solution of potassium bichromate. Subsequently I became convinced that this phenomenon was solely due to the extinction of the mercury, and have made a number of experiments regarding the phenomenon of which I present the following results. It is hardly necessary to state that the mercury used was absolutely pure. It is very difficult, but essential, to use chemically pure mercury, as even a very small trace of a foreign metal is often sufficient to influence the results materially. The experiments were made in ordinary test-tubes, in which the materials were shaken a length of time varying from a few seconds to ten minutes. I believe that we ought to distinguish between two methods or kinds of extinction, namely the mechanical and the chemical. The former is effected by a very large number of solutions of neutral salts, which exert no chemical action on mercury, and even by pure water, if shaken long enough. The extinction of the mercury in this case is produced simply by the interposition of fine films of the liquid between the globules, into which the mercury is separated by the mechanical agitation, and which are thus prevented from running together again. By mechanical extinction mercury is converted into what appears to be a fine powder, which, however, never loses its white colour and metallic appearance, and under the lens its globular structure is clearly seen. Quite interesting in many cases are the reactions which accompany the chemical extinction of mercury, which takes place when the metal is shaken with a solution of a salt, by which it is chemically affected. In these cases the newly-formed mercury compounds act in the same way as the films of liquid in the former instance, preventing the separate globules from reuniting. A finer division of the metal is obtained in less time than by the mechanical method, and the resulting metallic powder is generally of a dull gray leaden colour. When a solution of potassium bichromate is poured upon mercury, the convexity of the surface is at once destroyed; presently the surface is tarnished and begins to look wrinkled, while at the same time a greenish-black powder commences to deposit itself. This greenish-black powder is a mixture of chromic and mercurous oxide; it is formed abundantly when the two liquids are agitated more or less strongly; the mercury is at the same time completely extinguished, and at the end of the reaction neutral potassium chromate alone remains in solution, which is not acted upon by mercury. Ferric chloride extinguishes mercury; ferrous and mercurous chlorides are formed. Potassium permanganate also acts upon the metal; manganic and mercurous oxides are deposited, while potassic hydrate remains in solution. Mercury shaken with Fehling's solution is simply extinguished mechanically, when all the reagents used are pure; but when a very small quantity of zinc-amalgam is added, Cu_4O is reduced from the solution. A solution of potassium ferricyanide does not affect the fluidity of mercury; but when the two are shaken together a green powder is formed in large quantities, which, if allowed to stand, changes to a dark, and later still to a light blue colour. Potassium ferrocyanide appears to be formed at the same time. I am still engaged in studying this interesting reaction, and will endeavour to determine if this blue powder is Prussian blue or not. Sodium hyposulphite, also, does not affect the mercury physically; on agitation, however, a heavy black powder, mercuric sulphide, is formed. Its amount increases with the lapse of time, and in one of my test-tubes, which has hardly been disturbed for weeks, the original black sulphide has assumed a yellowish red colour. I conclude from these observations that the reducing power of pure mercury is greater than is generally supposed, and I expect to be enabled to obtain some interesting results from an extension of these experiments. I have repeated some of Lowe's experiments, which he described at our last meeting, and can state that similar results are obtained by substituting palladium bichloride for the platinum salt. I cannot, however, yet coincide with him in considering his final product as hydrogenium-amalgam, as by every method by which it has yet been made it contains another metal besides mercury and hydrogen, namely, either platinum, palladium, gold, or silver, in no inconsiderable proportion."

May 16.—The president in the chair. Mr. Frederick Prime, jun., read a paper on the Metallurgy of Argentiferous Galenas, giving details of the several processes at present in use, with their various advantages and disadvantages. He entered into a detailed account of the methods put into practice in Freiberg, and showed how these could, and would, be used in the United States.

BOOKS RECEIVED

AMERICAN.—Alaska and its Resources: W. H. Dall (Boston: Lee and Shephard).—Proceedings of the American Philosophical Society, No. 82.—Transactions of the Chicago Academy of Sciences, 1869. Parts 1 and 2.—Report of the Smithsonian Institute for 1868.—Proceedings (vol. ii. pt. 1) and Bulletin (Nos. 1-12) of the Essex Institute.—The Indians of Cape Flattery: G. G. Swan (Smithsonian Institute).

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